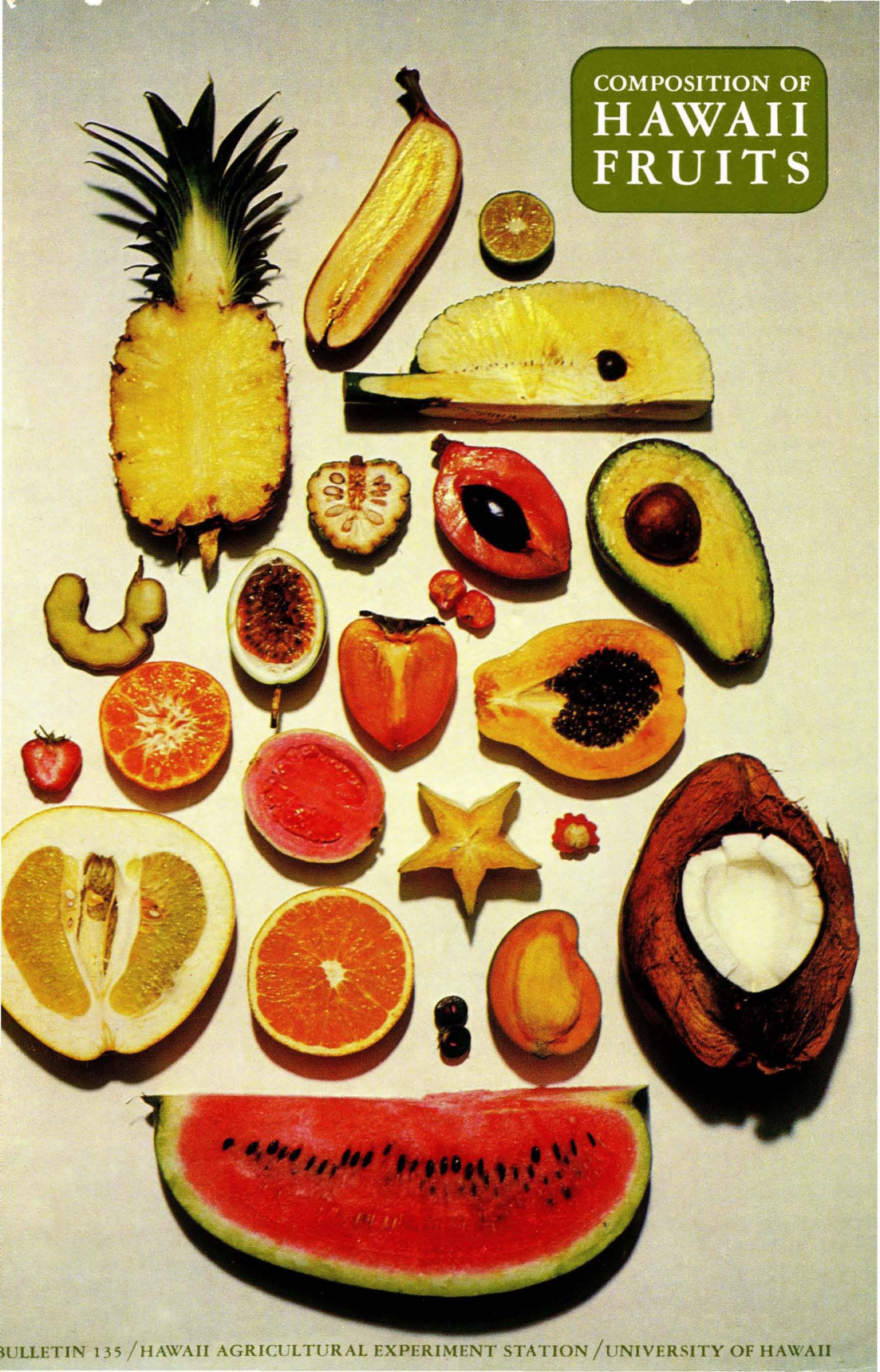

COMPOSITION OF HAWAII FRUITS

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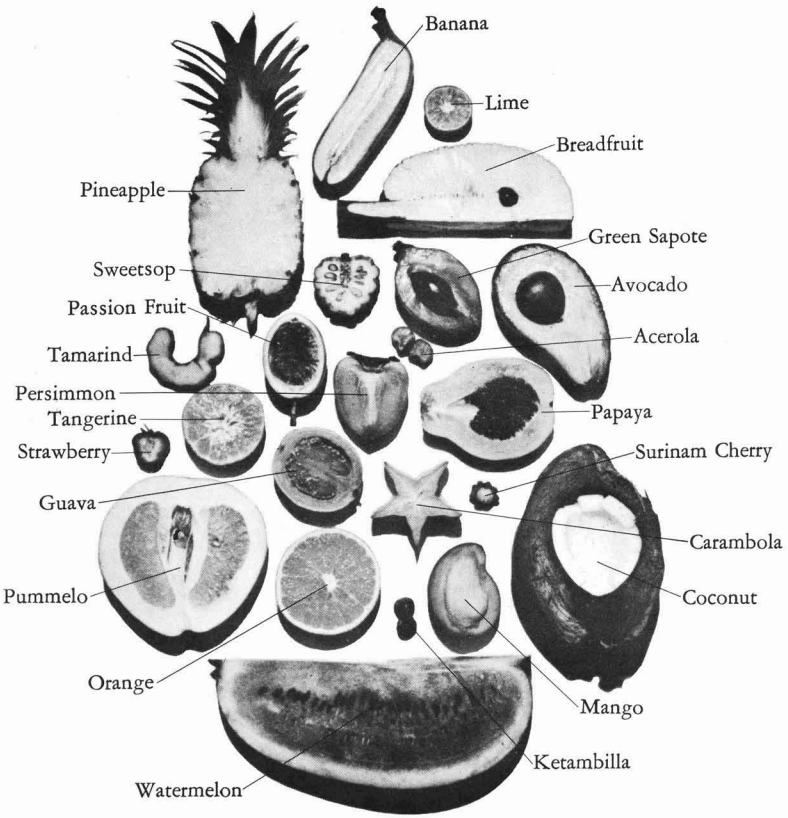

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COMPOSITION OF HAWAII FRUITS

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and
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UNIVERSITY OF HAWAII
COLLEGE OF TROPICAL AGRICULTURE
HAWAII AGRICULTURAL EXPERIMENT STATION
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We are indebted to Dr. Florence Pen (deceased, 1958) and Mrs. Florence Kee Ng for about half of the unpublished analytical work from the Department of Foods and Nutrition, and to Mrs. Mildred Ige for assistance in the calculations.

The people who prepared the publications listed under sources of data (p. 8) have also contributed to this bulletin.

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COMPOSITION OF HAWAII FRUITS

NAO S. WENKAM and CAREY D. MILLER

INTRODUCTION

Hawaii residents are fortunate in having available many fruits of tropical and semitropical origin, in addition to the familiar mainland fruits. This publication brings together data on food energy, proximate composition, three minerals, and five vitamins in about 60 fruits. Coconuts and macadamia nuts, though not classed as fruits, have been included. This publication has been prepared in response to repeated requests from nutritionists, doctors, dietitians, homemakers, educators, and other allied workers who are concerned with the nutritive value of foods in Hawaii, Asia, and other Pacific-basin countries.

Most of the fruits included have been introduced into the Hawaiian Islands since their discovery by Captain Cook; only the mountain apple, ohelo berry, and some of the bananas are indigenous species. Introduction of new varieties and a few species continues. The fruits analyzed include the most important ones grown in Hawaii and some of the less important.

At present, there is no readily accessible publication on the composition of fruits grown in Hawaii, as data have been lacking, or information previously available is out of print or in libraries only. Since this bulletin is of a technical nature it will be most valuable as a reference.

Fruits are essential for a good diet as a source of vitamins, organic acids, basic ash, and roughage. Attention should be given to the high nutritive value of some easily grown and generally available Hawaii fruits such as avocado, papaya, guava, mango, and acerola. The greater use of fruits, especially for desserts and between-meal snacks in place of high-carbohydrate sweets and drinks, is highly recommended.

SOURCES OF DATA

The food composition values are from chemical analyses and vitamin assays originating in the Department of Foods and Nutrition,[1] University of Hawaii, under the direction of one of the authors (CDM), with a few exceptions. About one-half of the figures are unpublished data—the work of Dr. Florence Pen, Mrs. Florence Kee Ng, and Mrs. Nao Sekiguchi Wenkam.

The other half are based on the original analytical data, determined for past Hawaii Agricultural Experiment Station publications, which were still available for use. About two-thirds of the published values are from analyses done for Technical Bulletin 30, *Vitamin Values of Foods Used in Hawaii* (*18*), and about one-third are from the proximate composition and mineral analyses done for Bulletin 77, *Some Fruits of Hawaii* (*17*). A small portion is taken from "The Composition of Hawaiian Fruits and Nuts," in the *Report of the Hawaii Agricultural Experiment Station* (*27*).[2] Parts of the data for coconut were taken from Bulletin 110, *Some Tropical South Pacific Island Foods* (*20*), and for macadamia nut from "Nutritive Value of Macadamia Nuts" (*15*). Most of the descriptive material is taken from *Fruits of Hawaii* (*16*).

To simplify the main tables, only one figure is given for each nutrient, although more than one assay may have been made. When analyses for a single fruit were done on more than one sample, i.e., vitamin values on one sample and the remaining nutrients on another sample, then the values were recalculated to a single moisture basis. Where more than one assay was done for a nutrient, adjusted mean averages are reported, except in a few cases where the combined judgment of the authors indicated that one or more should be omitted. Samples of each fruit are described in the Appendix.

EXPERIMENTAL PROCEDURE

Preparation and Sampling

The edible portions only were used for analyses. A list of the fruits analyzed, with a description of sample size, condition of fruit, portion considered refuse, and percentage of refuse, is given in the Appendix and in table 4.

In general, preparation involved washing the fruit with tap water and drying with cheesecloth or with an electric fan. The edible portions were thoroughly mixed and subsamples withdrawn for the individual nutrient analyses in a manner most conducive to the retention of each nutrient. For large items such as pineapples, papayas, avocados, etc., opposite lengthwise sectors were taken, cut into 1-inch pieces, thoroughly mixed, and subsamples taken for each nutrient.

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[1] Now called the Division of Nutrition, Department of Home Economics.

[2] The analytical methods used for the latter two publications (*17* and *27*) were essentially those of the official chemists at that time.

Analytical Methods

Moisture. The percentage of moisture of fruits was determined in duplicate or triplicate. From 5 to 50 grams of comminuted sample were dried for 48 hours in an electric oven at 70°C or lower. The samples were held *in vacuo* in a desiccator over silica gel for another 24 hours. Loss in weight was reported as moisture.

Protein. The Winkler boric acid modification of the Kjeldahl method was used (*11*). The organic nitrogen is converted to NH_3, which combines with H_2SO_4 to form $(NH_4)_2SO_4$; NH_3 is liberated by NaOH and combines with boric acid to form ammonium borate. This is measured by standard HCl. The factor 6.25 was applied to convert the nitrogen content to protein for all fruits

Fat. Ether extract was determined by the 1955 Association of Official Agricultural Chemists method for plants (*1*). The dry material was extracted with anhydrous ethyl ether for 4 hours in the Goldfisch fat extraction apparatus and the extract dried at 100°C to constant weight. Fat includes, in addition to the true fats, various fatty acids, sterols, chlorophyll, and other substances of similar solubility.

Crude Fiber. Crude fiber was determined by the 1955 Association of Official Agricultural Chemists method for plants (*1*). The ether extract residue was treated with boiling acid and with alkali for 30 minutes each. The residue was dried to constant weight at 110°C, weighed, ignited, and the loss in weight reported as crude fiber. It is made up largely of cellulose, hemicellulose, and lignin.

Total Ash. This refers to the total mineral matter residue after ignition of the sample. Samples of fresh material, weighing from 100 to 200 grams, were ashed in tared silica dishes in an electric muffle at about 525°C until a white or light gray ash was obtained, then cooled in a desiccator and weighed to determine total ash. When iron was to be determined, a reagent blank and recovery sample were added. Each ash was dissolved in HCl (1+4) and filtered. The residue and ashless filter paper were reheated in the muffle until a white ash was obtained. This was treated like the first ash, added to the filtrate, and made to volume. Aliquots were used for calcium and iron determinations.

Calcium. A modification of the McCrudden method for calcium, by Ingols and Murray (*7*), as recommended by the Human Nutrition Research Branch, Agricultural Research Service, U.S. Department of Agriculture (*28*), was used.

Phosphorus. A modification of the Fiske and Subbarow method (*5*), recommended by the Human Nutrition Research Branch, Agricultural Research Service, U.S. Department of Agriculture (*28*), was used.

Iron. Utilizing the ash solutions and blanks prepared as outlined under total ash, iron was estimated by the Saywell and Cunningham o-phenanthroline colorimetric method (*26*).

Carotene (provitamin A). The chromatographic method described by the Association of Vitamin Chemists (*2*) was used with slight modifications. This procedure depends upon the separation of the biologically active carotenoid pigments from the nonactive pigments in an extract by an adsorbent with varying affinities for the different pigments. The extracting solvents were 1% alcoholic potassium hydroxide, acetone, and petroleum ether (B.P. 60°–70°C) in equal proportions; the adsorbent, a 1:1 mixture of magnesium oxide and Hyflo Super-Cel; and the eluent, 3 to 10% acetone in petroleum ether. The color intensity was measured in an Evelyn colorimeter, using a 440 mμ filter, and the carotene concentration determined by reference to a calibration curve (90% beta- and 10% alpha-carotene mixture dissolved in petroleum ether). Three to 20 grams of sample were assayed in triplicate with a fourth aliquot for a recovery test.

Thiamine. The thiochrome procedure outlined by the Association of Vitamin Chemists (*2*) was used. This procedure depends upon the oxidation of thiamine to thiochrome, which fluoresces in ultraviolet light. Under standard conditions and in the absence of other fluorescing substances, the fluorescence is proportional to the thiochrome present and hence to the thiamine in the original solution. Triplicate aliquots and a recovery test were done on each sample.

Riboflavin. The fluorometric method outlined by the Association of Vitamin Chemists (*2*) was used. Riboflavin fluoresces and the intensity of fluorescence is proportional to the concentration in dilute solutions. Riboflavin is measured in terms of the difference between the fluorescence before and after chemical reduction. Triplicate aliquots and a recovery test were done on each sample.

Niacin. The microbiological assay method, as given by the Association of Vitamin Chemists (*2*), was used to determine niacin. The method is based on the observation that certain microorganisms require specific vitamins for growth. Using a medium complete in all requirements except niacin, the growth responses of *Lactobacillus arabinosus* are compared quantitatively in standard solutions and in sample extracts. The acid produced by the organism is measured to determine the extent of growth and thereby the amount of vitamin in the sample extracts. Duplicate aliquots and a recovery test were done on each sample.

Ascorbic Acid. Reduced ascorbic acid was determined by the dye (2, 6-dichlorophenolindophenol) visual titration method or photoelectric colorimeter method as given by the Association of Vitamin Chemists (*2*). The method is based upon the reduction of the dye by an acid solution of ascorbic acid. In the absence of interfering substances, the capacity of a sample extract to reduce a standard solution of the dye is directly proportional to the ascorbic acid content. Duplicate aliquots were done on each sample.

Conversion Factors and Notes on Nutrients

Protein, Carbohydrate, and Food Energy. Protein values were calculated from the total nitrogen content by applying the conversion factor of 6.25, as the proteins in fruits contain 16 percent nitrogen (*13*).

Carbohydrate, representing total carbohydrate by difference, was calculated by subtracting the sum of the percentages of water, protein, fat, and ash from 100 percent. It does not represent carbohydrate as defined chemically. The term includes sugars and starches, which the body uses almost completely; fiber and pentosans, which are used less completely; and organic acids, which are not carbohydrates in the chemical sense.

Food energy, expressed in terms of the large or kilogram calorie, was calculated using the factors 3.36, 8.37, and 3.60 for protein, fat, and total carbohydrate, respectively, as recommended by the U.S. Department of Agriculture (*13*). For lime juice, the factor 2.70 for total carbohydrate was used. For coconut and macadamia nut, the factors 3.47 and 4.07 were used for protein and total carbohydrate, respectively.

Vitamin A Value. The values for vitamin A are expressed in micrograms or International Units. Since plants contain no preformed vitamin A, the values are derived from the carotenoid pigments. One microgram of the yellow pigments, presumably biologically active carotenoids, was considered to be equivalent to 1 International Unit of vitamin A. It was the opinion of one of the authors (CDM) that this factor gave figures more nearly representative of the true nutritional values than to consider 0.6 microgram of pigments as equivalent to 1 International Unit, for the following reasons: (1) the method used does not differentiate between beta-carotene, its isomers, cryptoxanthin, and some other pigments which have a lower biological value than beta-carotene, or have no vitamin A value (*2, 3*); (2) the utilization (absorption and conversion) of the pigments by the animal body is influenced by a number of other factors in the diet (*23*); (3) the utilization of carotene in foods, in a series of human digestive experiments, was found to be so poor that a standard for carotene three times that for vitamin A was recommended (*6*); and (4) the Advisory Committee for the *Food Composition Table for Use in Latin America* (*9*) recommended that 0.9 microgram of carotene, when the isomers of carotene are unspecified, be used for the conversion of 1 International Unit of vitamin A.

Calcium, Phosphorus, and Iron. The mineral contents in the tables represent the total amounts of minerals as determined analytically; no attempt was made to determine their availability.

DESCRIPTION AND NUTRITIVE VALUE

A brief description of each fruit is given. Most are familiar fruits, but a few are somewhat uncommon. For more detailed descriptions, publications on pomology should be consulted.

The nutritive value of the fruit samples is discussed. Fruits are no longer classed as luxuries, for it has been recognized, with the discovery of vitamins, that man is dependent upon fruits for some vitamins, especially ascorbic acid. They are also important sources of organic acids, basic ash, and roughage.

Some fruits furnish only small amounts of nutrients, but the variety of flavor, texture, and color combines to make them a refreshing addition to any diet.

Most fruits analyzed have a relatively high moisture content. In this study, some contain over 90% water (more than milk or apple juice), e.g., acerola, carambola, grapefruit, mountain apple, roselle, strawberry, tangerine, and watermelon. On the other hand, avocado, banana, breadfruit, cherimoya, and green sapote have less water than most fruits, about 70%, and ripe tamarind, about 35%.

Most fruits contribute less than 2% protein. Only tamarind contains 3%, but this fruit is consumed infrequently and in small quantities in Hawaii.

The fat content is less than 1% with the notable exception of the avocados, which show a range of 10 to 25%. The highest value is found in the Beardslee, a Guatemalan–West Indian hybrid avocado.

The carbohydrate values range from 6% in items such as avocado and watermelon to 30 or 35% in banana and breadfruit. The carbohydrate is present mostly as starches and utilizable sugars. Cellulose and other forms of carbohydrate which are not well utilized are represented by the crude fiber value.

Calories are derived mainly from carbohydrates, as most fruits are low in protein and fat. Compared with equal weights of other foods, many fruits (e.g., acerola, the citrus fruits, mountain apple, strawberry, and watermelon) contribute fewer calories—an important consideration in reducing diets.

Fruits on the whole are poor sources of calcium, phosphorus, and iron. Nutritionists recommend that the daily diet of an adult male aged 25 should supply 0.8 gram of calcium and 10 milligrams of iron (*21*). The body requires at least as much phosphorus as calcium; but, generally, if dietary calcium and protein are adequate, the phosphorus requirement also will be covered (*21*). For comparison of the fruits in this bulletin, the following *arbitrary scale* has been used to rate the mineral content (*16*).

MINERAL	RATING		
	Good	Fair	Poor
	milligrams per 100 grams of edible fruit		
Calcium	more than 30	15 to 30	less than 15
Phosphorus	more than 40	25 to 40	less than 25
Iron	more than 1.0	0.5 to 1.0	less than 0.5

Cactus fruit, green sapote, whole red Cattley guava, macadamia nut, mulberry, papaya, and tamarind are good sources of calcium, containing over 30 milligrams per 100 grams. The Beardslee and Nabal avocados, breadfruit, coconut cream, macadamia nut, poha, sweetsop, and tamarind are good sources of phosphorus. Iron is high in carissa, coconut cream, whole common guava, macadamia nut, mulberry, and strawberry. Although tamarind contains large quantities of calcium and phosphorus, this fruit is not widely used—and then in such small quantities—that its total contribution to the diet is negligible as compared to such fruits as papaya which may be eaten every day.

The National Research Council recommends that the daily diet of a 25-year-old man should supply 5,000 International Units of vitamin A, 1.2 milligrams of thiamine, 1.7 milligrams of riboflavin, 19 milligrams of niacin equivalents, and 70 milligrams of ascorbic acid. For the needs of different age groups of men, women, and children, consult the NRC recommendations (*21*). For comparison of fruits in this bulletin, the following *arbitrary scale* has been used to rate the vitamin content (*16*).

VITAMIN	RATING			
	Excellent	Good	Fair	Poor
	milligrams per 100 grams of edible fruit			
Vitamin A value*	more than 1.0	0.5 to 1.0	0.1 to 0.5	less than 0.1
Thiamine	more than 0.2	0.1 to 0.2	0.05 to 0.1	less than 0.05
Riboflavin	more than 0.2	0.1 to 0.2	0.05 to 0.1	less than 0.05
Niacin	more than 2.0	1.0 to 2.0	0.5 to 1.0	less than 0.5
Ascorbic acid	more than 40	25 to 40	10 to 25	less than 10

* One milligram = 1000 micrograms

Fruits have no vitamin A, but those having yellow, orange, or red color contain carotenoid pigments. These can be changed by the body to vitamin A and are referred to as provitamin A. This term is used in this bulletin to indicate the vitamin A value. Foods with no color, such as lychee, are assumed to have little or no vitamin A value. Excellent sources of provitamin A are the Beardslee avocado, loquat, Haden and Pirie mangos, papaya, yellow passion fruit, poha,

and Surinam cherry. Good sources of provitamin A are Nabal avocado, Popoulu banana, green sapote, orange, purple passion fruit, persimmon, and tangerine.

On the whole, fruits are poor sources of the B vitamins when compared with other food groups. Macadamia nut is an excellent source of thiamine; good sources are breadfruit, cherimoya, orange, poha, sweetsop, tamarind, and tangerine. For riboflavin, excellent sources are the Beardslee avocado and tamarind. Eight others—Nabal avocado, Maiamaoli banana, cherimoya, macadamia nut, mulberry, purple passion fruit, yellow passion fruit, and soursop—are good sources. Only the yellow passion fruit is an excellent source of niacin. Twelve others—Hulumanu avocado, breadfruit, cherimoya, green sapote, common guava, Kwai Mi lychee, macadamia nut, purple passion fruit, poha, soursop, tamarind, and wi-apple—are good dietary sources of niacin.

Fruits make their greatest contribution as a source of ascorbic acid. Acerola is probably the most potent source, containing 50 times as much as an equal weight of a good orange. Also, some guavas contain 7 or 8 times as much vitamin C as the orange. Some other fruits that are superior sources of ascorbic acid are carissa, grapefruit, ketambilla, lychee, orange, papaya, poha, strawberry, and wi-apple. In addition, cactus fruit, carambola, green sapote, red Cattley guava, Java plum, lime, mulberry, purple passion fruit, pummelo, sweetsop, and tangerine are good dietary sources of this vitamin.

Acerola *(Malpighia glabra)*

Description. This small, cherrylike fruit, which is native to tropical and subtropical America, is often referred to as the Barbados, the West Indian, or the Puerto Rican cherry. The fruit is borne on short stems on a shrublike tree which will grow to approximately 12 feet in height. The fruit varies in size from about ½ to 1 inch in diameter, and weighs from 2 to 10 grams. The thin skin may be light reddish-yellow or deep red when ripe. The flesh is usually of a reddish-yellow hue, although some types with dark-red skins also have dark-red flesh. The three-winged seeds are large in comparison to the flesh, but because they are light and pithy they constitute only about 20% of the weight. The fruit is sweet to acid in taste (depending upon the genetic type), with no distinct or pronounced flavor. Some think the flavor of the thoroughly ripe acerola and the fresh, raw juice made from it resembles that of tart strawberries. Although commonly called a cherry, the odor and flavor of cooked acerola are more like those of tart apples or crab apples than cherries. Malic acid, the only organic acid (other than ascorbic acid) which acerola contains, is also the principal acid in apples (*25*).

Nutritive Value. Acerola is an exceptionally rich source of ascorbic acid. It contains approximately 30 to 50 times as much ascorbic acid as orange juice on an equal weight basis, so that one or two cherries, depending on the size and on the concentration of ascorbic acid, will furnish sufficient vitamin C to supply the recommended daily allowance.

Avocado (*Persea americana* and *P. drymifolia*)

Description. There are three races of avocados represented in Hawaii, with the following characteristics:

(1) West Indian race. Summer and fall maturing; fruit large; skin smooth and leathery in texture, and not more than 1/16 inch in thickness.

(2) Guatemalan race. Winter and spring maturing; fruit large; skin rough and woody in texture, and 1/16 to 1/4 inch in thickness.

(3) Mexican race. Leaves and immature fruit anise-scented; fruit small; skin smooth and thin.

Many of the avocados found in Hawaii are of hybrid origin and may not be readily identifiable with the three races. The fruit is pear-shaped, round or obovoid, and sometimes weighs more than 3 pounds. The green skin, which changes in some varieties to red, purple, or purplish-black as the fruit matures, varies from smooth to warty in texture. The yellow or light-green flesh which surrounds the single large seed is smooth in texture. The best varieties have very little fiber in the flesh and a characteristic nutty flavor.

Nutritive Value. With the exception of the olive, no other fruit contains as large a percentage of fat as the avocado. The fat content varies from 9 to over 25%, according to variety and race.

In experiments on human digestion, the digestibility of the oils in fresh avocados was first found to be 93.7% (*12*), a value comparable to that for butter, but later experiments gave a value of 82.5% (*4*).

Avocados are a fair to good source of phosphorus, a good source of pro-vitamin A, riboflavin, and niacin.

Banana (*Musa* spp.)

Description. The banana is now one of the best-known fruits throughout the world. Of the common varieties, the cylindrical fruit varies in size from the small Chinese (Cavendish), 4 to 5 inches in length, to the large Bluefields (Gros Michel), 8 to 9 inches in length. The tough outer peel, though commonly yellow, may also be greenish-yellow or reddish-brown when ripe. The edible portion is generally creamy white in color, or creamy pink in some varieties. Dessert bananas may be eaten raw or cooked, but the plantains are more palatable after being cooked.

Nutritive Value. Greater use should be made of bananas because they are economical, nutritious, and available everywhere in Hawaii. In the half-ripe stage, one-half to one-third of the total carbohydrate may be in the form of starch and may cause digestive disturbances. When fully ripe, practically all the carbohydrate is in the form of sugars, and the fruit is readily digested even by infants.

Steaming whole cooking bananas for 20 minutes did not reduce the vitamin content appreciably (*18*).

Breadfruit *(Artocarpus communis)*

Description. The seedless type of breadfruit commonly found in Hawaii and known as the Hawaiian breadfruit is a large, round or oblong fruit 4 to 8 inches in diameter. The rind, green in the unripe stage, acquires a greenish-brown or yellow tint as the fruit matures. The slightly fibrous pulp surrounds a tough central core. The pulp is white, bland, and starchy in the green stage; light yellow and sweet in the ripe stage.

Nutritive Value. Breadfruit has about the same quantity of total carbohydrate (starch and sugar) as sweetpotato and taro, and more than the white potato. Like banana, breadfruit when fully ripe gives no test with iodine, indicating that all the starch has been changed to sugar.

The calcium content of breadfruit is higher than that of white potato and about the same as that of sweetpotato and taro. Compared with other fruits, breadfruit is considered to be only a fair source of calcium, but when eaten in large quantities it can supply a good proportion of the day's needs.

Breadfruit is a good source of phosphorus, thiamine, and niacin. Baking for 1 hour at 325°F did not reduce the vitamin content appreciably (*18*).

Cactus Fruit *(Opuntia megacantha)*

Description. The cactus fruit is ovoid or pear-shaped, about 3 inches long, and 2 to 3 inches in diameter. It is yellow or dark purple and covered with fine spines and bristles. The pulp is sweet but bland and contains many hard seeds.

Nutritive Value. The cactus fruit is a good source of calcium and ascorbic acid.

Carambola *(Averrhoa carambola)*

Description. The carambola is a translucent yellow or yellow-green fruit 4 to 5 inches long and 2 to 3 inches in diameter. It has five prominent ribs which make it distinctly star-shaped in cross section. The thin waxy skin encloses a very juicy pulp and several smooth brown seeds. There seem to be two types—the sweet and the sour. Both are mild flavored.

Nutritive Value. The carambola is a good source of ascorbic acid.

Carissa *(Carissa grandiflora)*

Description. The fruit of the carissa is ovoid or round and varies in size and shape. A medium-size fruit is about 1 inch in diameter and 1½ inches long. The skin of the fully ripe fruit is bright crimson and sometimes streaked with darker red; it is thin and bruises easily. The flesh is deep red, or crimson, with white mottling. In the center there are about 12 small, brown, flat seeds. The fresh fruit has a mild, slightly pungent flavor, is slightly granular in texture, and is somewhat astringent.

When bruised, broken, or cut, the fruit and branches exude a white latex that is harmless, except that it may be irritating if it comes in contact with the eye.

Nutritive Value. The carissa has relatively large quantities of sugar and sufficient acid and pectin to make a good jelly. It is an excellent source of ascorbic acid, containing somewhat more than the average orange, and a good source of iron.

Cherimoya *(Annona cherimola)*

Description. The cherimoya is a green, heart-shaped fruit, 3 to 7 inches long, and has a smooth custardlike consistency. It contains from a few to many dark-brown seeds. The pulp is white, well flavored, slightly acid, with a characteristic pattern of rounded protuberances and indentations over the surface of the skin.

Nutritive Value. The cherimoya is a good source of thiamine, riboflavin, and niacin.

Coconut *(Cocos nucifera)*

Description. The coconut is the large, one-seeded fruit of the coco palm. The endosperm within the nut is the edible portion. A fibrous husk encloses the brown, hard-shelled nut, which is usually 4 to 5 inches in diameter.

G. P. Wilder states: "After being fertilized by the adjacent staminate flowers, the hollow interior of the shell becomes filled with sweet water. The spherical fruits gradually increase to from 4 to 8 inches in diameter. The endosperm, at first an opaque, jellylike substance, forms in the inner walls of the shell, and gradually absorbs the water; it attains a firm thickness of from 0.25 to 0.5 inch. This is known as the 'coconut meat' and forms an important article of diet for the Polynesian people." (*29*).

In the early stages the meat is soft and jellylike. Later, the meat becomes crisp and firm. In this bulletin, the watery liquid within the coconut is called "water" and the juice obtained by squeezing the grated coconut meat is called "cream."

Nutritive Value. The chemical composition of the edible portion of the coconut varies with the stage of development.

Immature nuts contain from 300 to 700 milliliters of water, and the average pH is 4.7 (*17*). The meat begins to form when the nut is 6 months old; that is, 6 months after the spathe has opened. As the meat develops, its water content gradually decreases, the fat and total ash increase, and the protein and sugar content show less marked changes (*8*). The mature nuts contain a relatively large amount (5.4%, fresh weight) of crude fiber (*27*).

Analyses of expressed coconut cream show it to be high in fat (25 and 35%) and low in protein (3 and 4%). It is a good source of phosphorus and iron. It has been pointed out that neither coconut water nor coconut cream is comparable to cow's milk in organic nutrients or calcium or phosphorus content (*14*).

Fig *(Ficus carica)*

Description. The leading variety of fig grown in Hawaii is known as the Turkish Brown or Brown Turkey, commonly called Turkey. It is pear-shaped, 1½ to 3 inches in diameter, and of mahogany-red color if exposed to the sun. The thin, easily bruised skin encloses a soft, pinkish-white pulp and many tiny seeds. The fruit matures from a large number of small flowers which develop within a protecting shell. This accounts for the small hollow in the center of the pulp, around which can be seen a layer of seeds and tiny dried flowers. The flavor is sweet and pleasing.

Nutritive Value. Brown Turkey figs are a fair to poor source of all the minerals and vitamins studied.

Grape, Isabella *(Vitis labrusca* × *V. vinifera)*

Description. The Isabella grape is an American type slipskin grape. The bunches are from 4 to 6 inches long and are very firmly packed. When ripe, the individual grapes are a deep purple-black with a light-blue bloom, and are about ½ inch in diameter.

Nutritive Value. Grapes have a distinctive flavor and refreshing qualities. The acids of Concord grapes (a related variety) consist of approximately 60% malic acid and 40% tartaric acid, a large portion of which exists in the form of alkali salts (*22*). Isabella grapes are a poor to fair source of the minerals and vitamins studied.

Grapefruit *(Citrus paradisi)*

Description. The grapefruit is globose, yellowish-green in color, and 3 to 4 inches in diameter. The pulp is pale yellow, greenish-yellow, or pink, and is composed of large distinct sacs; it varies in degree of juiciness and acidity according to variety and environment. The term pomelo is sometimes used instead of grapefruit, but the latter term has come to be the one most favored. (*See also* Pummelo, p. 25.)

Nutritive Value. The grapefruit is an excellent source of ascorbic acid.

Green Sapote *(Calocarpum viride)*

Description. The green sapote fruit resembles some persimmons, ovoid and pointed at the blossom end. It is 3 to 4 inches in length and tawny brown in color when mature. The fruit is astringent when green but sweet when thoroughly ripe.

Nutritive Value. The green sapote is a good source of calcium, provitamin A, niacin, and ascorbic acid.

Guava, Cattley *(Psidium cattleianum)*

Description. In addition to the common guava, there are two kinds of strawberry guavas in Hawaii—the dark-red strawberry guava (*Psidium cattleianum*)

and the yellow (*Psidium cattleianum* var. *lucidum*). The fruit is round, and ¾ to 1½ inches in diameter. The center of the fruit is filled with a very juicy pulp and numerous small, hard seeds. It has a sweet and somewhat acid flavor. The yellow Cattley guava resembles the red but is a larger fruit.

Nutritive Value. The Cattley guava is a good source of ascorbic acid and calcium.

Guava, Common *(Psidium guajava)*

Description. The guava is a medium-size, round or lemon-shaped fruit, 1½ to 3½ inches in diameter, with a thick, coarse, edible rind surrounding a mass of seeds imbedded in a firm, soft pulp. The flesh color varies from white to yellow to red. Though the fruit may be either sweet or sour, it always has a distinct characteristic flavor and aroma.

Nutritive Value. The guava is a good source of niacin. The fruits vary greatly in ascorbic acid content, some having 2 to 5 times as much as others, but all may be considered excellent sources of this vitamin. The thick rind portion contains more ascorbic acid than the pulp and seeds, because there is a greater proportion of the rind than pulp in each guava, and because the rind is richer in ascorbic acid per unit of weight (*19*).

Java Plum *(Eugenia cuminii)*

Description. The Java plum, or jambolan, is a small, dark-maroon or purple fruit about the size and shape of an olive. There are at least two types in Hawaii, one with small, somewhat irregular-shaped fruit and one with slightly larger, symmetrical, olive-shaped fruit. The smaller variety has purple flesh, and the larger type has whitish flesh. The white-fleshed Java plum is sweeter and less astringent than the purple-fleshed variety. The astringent quality is believed to be due to the presence of tannins (*16*).

Nutritive Value. The Java plum is a good source of ascorbic acid.

Ketambilla *(Dovyalis hebecarpa)*

Description. In size and shape the ketambilla resembles a small plum or cherry. It is globose and varies from ½ to slightly more than 1 inch in diameter. The ketambilla has a thin, tough, deep-purple skin covered with short, gray-green hairs which give it a velvety or frosted appearance. There are 9 to 12 small seeds imbedded in the fibrous, deep-maroon or purple flesh. It has a strong acid flavor and stains a deep red or purple. The fruits hang by short stems on the underside of the thorny branches of a shrub that grows to a height of 10 to 15 feet.

Nutritive Value. The ketambilla is an excellent source of ascorbic acid.

Lime *(Citrus aurantiifolia)*

Description. The acid lime is a small citrus fruit of characteristic flavor. Several varieties are grown successfully in Hawaii. The common Chinese lime, also known as Mexican, or Key, lime is a small, globose or ovoid fruit about 1½ to 2¼ inches in diameter. Its thin skin varies in color from light yellow to green. The flesh, yellow-green and very juicy, contains large quantities of citric acid.

Nutritive Value. The small quantities of limes used in the average diet make their nutritive value of minor importance. They yield an alkaline ash in the body because their high acidity is due to citric acid and its basic salts. They are good antiscorbutics, though the different varieties vary somewhat in their content of ascorbic acid.

Loquat *(Eriobotrya japonica)*

Description. The yellow, downy, loquat fruit is globose or ovoid, from 1½ to 2½ inches long. The white or yellow flesh enclosing a few large seeds has a pleasant acid flavor. Ripe clusters are sold in the markets.

Nutritive Value. The loquat is an excellent source of provitamin A. Although its acidity might suggest to some that it should be a good source of ascorbic acid, two samples showed only traces of ascorbic acid, which is confirmed by published values (*9*).

Lychee *(Litchi chinensis)*

Description. The lychee is a small, ovoid fruit about 1½ inches in diameter. The outer shell-like covering is red and the flesh surrounding the single brown seed is translucent white. The size of the seed varies considerably. The sweet and slightly acid flavor of the fresh lychee reminds many people of the Muscat grape. The dried fruits, known as "lychee nuts," are very different from the fresh, bearing somewhat the same relationship to the fresh fruits as raisins to grapes.

Nutritive Value. Of the two varieties analyzed, the Brewster and Kwai Mi, the latter is considered superior in flavor and quality, although it is a smaller fruit. Both are excellent sources of ascorbic acid. Kwai Mi is a good source of niacin.

Macadamia Nut *(Macadamia integrifolia)*

Description. The macadamia nut is enclosed in a smooth, extremely hard shell. Although the raw, white kernel has a delicious flavor, resembling hazelnuts or almonds, cooking in hot oil enhances the flavor. Consequently, practically all commercial macadamia nuts in Hawaii are marketed cooked, with or without salt.

Nutritive Value. Like all nuts, macadamia nuts are a concentrated food, low in moisture and high in fat, protein, and carbohydrate. They are a good source

of calcium, phosphorus, and iron, and of the B vitamins, thiamine, riboflavin, and niacin.

Mango *(Mangifera indica)*

Description. Many recognized varieties of mangos as well as unnamed hybrids are grown in Hawaii. In general, the mango can be described as a medium-size fruit from 2 to 4 inches in diameter and from 3 to 7 inches in length. The skin, which is smooth and thick, is strong enough in some varieties to be pulled from the flesh when the fruit is ripe. In most varieties, as the fruit matures, the green skin changes to more brilliant colors—purplish-red shading to green, deep crimson, or yellow with red spots.

The flesh varies in color from pale lemon to deep apricot. In the most prized varieties, it is juicy, smooth, and free from fiber. The flavor, which varies greatly, may be insipid or sweet, or reminiscent of turpentine. In the better varieties, the flavor and texture are excellent. Though sometimes compared to good peaches, mangos have a characteristic, delicious flavor of their own.

Nutritive Value. Mangos have sufficient yellow pigment to make them good to excellent sources of provitamin A. Different varieties of mangos vary greatly in ascorbic acid content. For example, two favorites, the Pirie and Haden, are only fair sources, whereas others, including some of the common types, are excellent sources of ascorbic acid. All varieties tested contained more ascorbic acid in the green stage than in the half-ripe stage and more in the half-ripe stage than in the ripe stage (table 7). For detailed information regarding the ascorbic acid content of various varieties of mangos grown in Hawaii, see table 5.

Mountain Apple *(Eugenia malaccensis)*

Description. The mountain apple is an ovoid fruit from 2 to 3 inches long. It has a very thin, crimson skin shading to pink or white. The crisp, white flesh is juicy and of pleasant though not distinctive flavor. Each fruit contains one or two large, brown seeds. The fruit is easily bruised and stains the hands deep purple.

Nutritive Value. The mountain apple is a poor to fair source of the minerals and vitamins studied.

Mulberry *(Morus nigra)*

Description. The black mulberry, a native of Persia and the Caucasus, is a small fruit that varies greatly in size but rarely exceeds 1¼ inches in length and ½ inch in diameter. Perhaps due to lack of cross pollination, it often appears in Hawaii in a seedless form, which may become a permanent variety. The seedless type is an excellent, well-flavored, subacid fruit that should be more widely cultivated. Mulberry trees will grow to a height of 20 to 30 feet in Hawaii, but

for fruit production they may be trimmed to the size of a small tree or even a shrub and used as a hedge. The best quality fruit is produced when the tree is well trimmed and well watered.

Nutritive Value. The mulberry is a good source of calcium, iron, riboflavin, and ascorbic acid.

Ohelo Berry ***(Vaccinium reticulatum)***

Description. The ohelo belongs to the cranberry family. Its fruit is globose, red or yellow in color, may or may not be covered with bloom, and contains a considerable number of small, flattened seeds. The size varies from ¼ to ½ inch in diameter. It is edible either raw or cooked.

Nutritive Value. Ohelo berries are a poor to fair source of the minerals and vitamins studied.

Orange ***(Citrus sinensis)***

Description. Several varieties of oranges have been introduced into Hawaii. At the present time, the Washington Navel is the principal variety grown commercially. This orange is medium to large in size, with the characteristic navel on the blossom end. In Hawaii's climate the skin does not develop the bright orange color seen in cooler climates. The flesh is juicy and varies from acid to sweet according to maturity.

Nutritive Value. The food composition of the Hawaii-grown oranges is similar to that of oranges grown on the Mainland. They are a good source of provitamin A and thiamine, and an excellent source of ascorbic acid.

Papaya ***(Carica papaya)***

Description. The papaya is a melonlike fruit which varies greatly in size and shape. The Solo variety is a small fruit from 3 to 5 inches in diameter. The skin is smooth and thin, shading from green to deep orange. The flesh varies in thickness from 1 to 2 inches and from pale yellow to deep salmon-pink in color. Numerous round, black, wrinkled seeds, each enclosed in a gelatinous membrane, cling to the inner wall. The flavor and odor of the fruit are distinctive. The white latex that exudes from the leaves, stems, and unripe fruit is very irritating if it comes in contact with the eye.

Nutritive Value. Green, unripe papaya contains papain, a protein-splitting enzyme, but the ripe fruit is believed to contain little or none of this enzyme. The papain is probably not of any nutritional significance in aiding the digestion of protein, but it may be the reason that a few people experience some digestive distress after eating papaya.

The Solo variety is a good source of calcium and an excellent source of provitamin A and ascorbic acid.

Weekly tests were made for a year on the ascorbic acid content of Solo papayas from two localities on Oahu, Poamoho and Kailua. The ascorbic acid

content ranged from 60 to 122 milligrams per 100 grams, mean 84 milligrams (*19*). In papaya, ascorbic acid increases as the fruit ripens. When the skin is dark green and the flesh pale yellow, the fruit contains only 60 to 70% as much ascorbic acid as when ripe (table 7).

Passion Fruit *(Passiflora edulis)*

Description. The passion fruit is a medium-size oval fruit from 2 to 3 inches long. There are three types common in Hawaii, the purple (*Passiflora edulis*), the yellow (*Passiflora edulis* forma *flavicarpa*), and the orange (*Passiflora ligularis*), commonly called sweet granadilla or water lemon. Several other species are seen only occasionally. In these three types, the brittle shell encloses a juicy, yellow pulp and many small seeds. Although the shell dries up and becomes wrinkled after the fruit has matured, the pulp remains in good condition for several weeks.

Nutritive Value. The juice of the yellow passion fruit is an excellent source of provitamin A and niacin and a good source of riboflavin.

The juice of the purple passion fruit is a good source of provitamin A, riboflavin, niacin, and ascorbic acid.

The passion fruit juice keeps well because of its natural high acidity. The acidity of the purple and yellow juices was found to be 2.3 and 3.9%, respectively, calculated as citric acid (*17*).

Persimmon *(Diospyros kaki)*

Description. The persimmon fruits are ovoid to flattened globose, orange-red or yellow in color, thin-skinned, and 2 to 3 inches in diameter. The fruits of most varieties are astringent when green, sweet when thoroughly ripe, and contain one to ten large, flattened seeds. Some are seedless.

Nutritive Value. The persimmon is a good source of provitamin A.

Pineapple *(Ananas comosus)*

Description. The pineapple is a collection of small fruits, so it is called a multiple fruit. In the flower stage, the corollas are separate but the ovaries are fused, giving the appearance of a cluster of flowers on a single stalk.

The mature pineapple, a large fruit shaped like a pine cone, is about 6 to 10 inches in height and weighs 5 to 8 pounds. It grows on a stalk, or peduncle, that is a continuation of the plant stem of the low, cactuslike pineapple plant. The tough and horny rind is composed of small hexagonal sections, fitted together like pieces of tile. Each of these sections marks a botanically individual fruit.

The skin of a ripe pineapple may be deep yellow, chocolate-green, or mottled green and brown. The flesh is very juicy and has a somewhat fibrous texture.

It varies in color from pale to deep yellow. The edible portion surrounds a tough central core, which was originally the flower stalk.

Nutritive Value. The pineapple has long been valued for its distinctive flavor and refreshing qualities. Fresh, ripe pineapple is a good source of sugar. The Smooth Cayenne variety is a poor to fair source of the minerals and vitamins studied. The Pineapple Research Institute of Hawaii is developing new varieties that contain larger quantities of ascorbic acid than the Smooth Cayenne.

Of the nonvolatile acids in pineapple juice, about 87% is citric and about 13% is *l*-malic (*22*).

Some people find that eating large quantities of fresh pineapple causes a soreness of the mouth and esophagus. It has been suggested that this irritation may result from the combined action of the acid, the protein-splitting enzyme (bromelin), and the calcium oxalate crystals.

Pineapple does not increase in sweetness after it is harvested because there is no starch stored in the fruit which will change to sugar. The sugars are formed in the leaves of the pineapple plant and transferred to the fruit. Pineapple is usually sweeter in the summer months, when the days are longer and the sunshine more abundant.

Plum, Methley *(Prunus cerasifera × P. salicina)*

Description. The only variety of plum grown extensively at higher elevations in Hawaii is the Methley. The fruits vary in shape; some are globose, and others tend to be slightly ovoid with a distinct point at the blossom end. The size also varies, but good plums are 1½ to 2 inches in diameter.

The dark-red skin has a light bloom and the flesh, which is a rich red color, adheres rather tightly to the seed. When picked prematurely, the plums may be very sour, but when fully ripe the flesh is sweet, though tart, and of good flavor. The skin, like that of many other plums, is bitter.

Nutritive Value. The Methley plum is a poor source of the minerals and vitamins studied.

Poha *(Physalis peruviana)*

Description. The poha is a small, yellow-green or orange fruit resembling a cherry in size and shape. It is enclosed in a thin, cream-colored, paperlike husk. The skin of the fruit is thin and waxy and surrounds a juicy pulp which contains many small seeds. The poha, also called Cape gooseberry or husk tomato, is related to the ground cherry.

Nutritive Value. Pohas are a good source of phosphorus. They are an excellent source of provitamin A and ascorbic acid, and a good source of thiamine and niacin.

Pummelo or Shaddock *(Citrus grandis)*

Description. The pummelo fruit is globose to pear-shaped, 5 to 7 inches in diameter, with thick, smooth, pale-yellow skin. The pulp is often dry, subacid, and yellow or slightly pink in color. This fruit should not be confused with pomelo, for which grapefruit is the preferred term.

Nutritive Value. The pummelo is an excellent source of ascorbic acid.

Roselle *(Hibiscus sabdariffa)*

Description. The roselle is an annual plant that commonly grows to a height of 5 to 8 feet in Hawaii. The fleshy, bright-red calyx is the portion of the plant that is used as a fruit.

Nutritive Value. The roselle is very acid to taste and has little or no sugar. It is a poor to fair source of the vitamins studied.

Soursop *(Annona muricata)*

Description. The soursop is a large, irregularly heart- or kidney-shaped fruit. A single fruit may weigh 5 pounds or more and measure 10 inches or more in length. The thick skin, or rind, is a deep green and covered with numerous, soft, curved spines. The flesh resembles cotton soaked in a sweet, aromatic liquid. The pulp contains many shiny, brown seeds.

Nutritive Value. The juicy pulp of soursop is a good source of riboflavin and niacin.

Strawberry (*Fragaria* spp.)

Description. The cultivated strawberry is a juicy, red fruit which grows on a low, herbaceous plant. Structurally, it is an enlarged fleshy receptacle from ½ to 1¼ inches in diameter, on the outside of which are imbedded many small seeds. The flavor combines acidity and sweetness in proportions pleasing to most people. Some varieties are more strongly flavored than others.

Nutritive Value. Strawberries are a good source of iron. The value is higher than that reported in the literature. Local strawberries of an unknown variety are an excellent source of ascorbic acid.

Surinam Cherry *(Eugenia uniflora)*

Description. The Surinam cherry is a small bright-red fruit about 1 inch in diameter, oblate in form, and conspicuously eight-ribbed. When ripe, it varies in color from a glistening light red to a very dark red. The flesh surrounding the single, large seed is soft and juicy. The fruit from most plants is distinctly acid and slightly bitter, but some plants produce subacid, sweet fruit.

Nutritive Value. The acidity of Surinam cherries is great compared with other fruits in this series; it is exceeded only by the tamarind and the yellow passion fruit. Two samples of expressed juice had pH values of 2.7 and 3.0 (*17*).

Surinam cherries are an excellent source of provitamin A.

Sweetsop *(Annona squamosa)*

Description. The sweetsop fruit is ovoid and covered with large knobs which separate into sections when ripe. The pulp is creamy white, granular, and sweet with a pleasant flavor.

Nutritive Value. The sweetsop is a good source of phosphorus. It is a good source of thiamine and ascorbic acid.

Tamarind *(Tamarindus indica)*

Description. The fruit of the tamarind tree consists of a brittle brown pod, varying from 2 to 6 inches in length and from ½ to 1 inch in width. The pod encloses a very sticky, acid pulp which surrounds from 1 to 12 shiny, brown seeds. In maturity, the edible pulp shrinks slightly from the pod.

Nutritive Value. Analyses from the Department of Foods and Nutrition indicate that tamarind pulp, as compared with all other fruits, has an unusually high acid and high sugar content. The acid is reported to be largely tartaric (*24*). The acid of the sample analyzed in this department was calculated as 14% tartaric, or as 12% citric acid. One investigator (*24*) reports an invert sugar content of 41.2% for tamarind pulp, and analyses from this department show a carbohydrate by difference of 59.8%. The calcium and the phosphorus content are also unusually high; the value of 0.113% for calcium is one of the highest reported in the literature for any fruit and is equivalent to that reported for some vegetables. Whether the calcium is well utilized by humans is unknown. The ripe tamarind is a good source of thiamine and niacin, and an excellent source of riboflavin. Though its high acidity might suggest to some that it should be a good source of ascorbic acid, numerous tests of the fruit in both the ripe and green stages have shown the variety grown in Hawaii to contain trace amounts only.

Tangerine *(Citrus reticulata)*

Description. The tangerine fruit is flattened-globose, 2 to 3 inches in diameter, with a loose skin which may shade from green to orange in color at maturity. The flesh is orange-colored, sweet, and usually contains numerous seeds.

Nutritive Value. The tangerine is a good source of provitamin A, thiamine, and ascorbic acid.

Watermelon *(Citrullus vulgaris)*

Description. The watermelon, a large, smooth, green melon, is cultivated in many sections of the world. The rind varies from ⅜ to 1½ inches in thickness and, from the outside in, shades from green to white to pink in color. The crisp, juicy, pink flesh contains many flat, slippery, black or white seeds. In good melons, the flavor is delicate, sweet, and refreshing. The watermelons grown in Hawaii average from 10 to 30 pounds. The Chilean Black Seeded variety has a thin rind. The Charleston Gray, a larger variety, has a thicker rind, from ½ to 1 inch in thickness.

Nutritive Value. Watermelons, like strawberries and mountain apples, contain 90% or more of water and 7 to 8% of carbohydrate in the form of sugar. Watermelons are a poor to fair source of the minerals and vitamins studied.

Wi-apple *(Spondias cytherea)*

Description. The wi-apple is apple-shaped, 2 to 3 inches long, and pale yellow in color when ripe. The yellow fibrous pulp surrounds a large central pit which contains seeds.

Nutritive Value. The wi-apple is a good source of niacin and an excellent source of ascorbic acid.

RESULTS AND DISCUSSION

The tables present values for nutrients that are of importance in evaluating diets and planning meals. These nutrients are: protein; fat; and carbohydrate; two minerals—calcium and iron; and five vitamins—vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. The percentage of water, the food energy expressed in calories, and the phosphorus values are also shown.

Table 1 gives the food composition per 100-gram quantities of the edible portion, the unit widely used in research.

In table 2, the quantities of nutrients are expressed in household units and common portions, a form useful to dietitians, doctors, nutritionists, and homemakers. The size measurement is for each fruit "as purchased," abbreviated AP, and the weight in grams for the "edible portion" as described. But in a few cases inedible parts are included in the description (e.g., acerola, grape, and roselle, 1 cup AP, and grapefruit, ½ medium AP), in which case the weight includes the inedible parts. The nutritive value is for the edible portion only.

In table 3, the 100-calorie portion is the basis for the amount of food listed. This unit is commonly used by the Hawaii Cooperative Extension Service agents, as it is easily understood by a wide group of women.

Table 4 presents the portions considered refuse and percentage of refuse.

In using tables of food composition such as these, it is important to remember that variations exist in the amounts of nutrients present in different samples

of the same kind of food. The nutrients are affected by many factors, such as environment (i.e., soil and climate), cultural practices, genetics, and treatment after harvest (i.e., storage conditions or processing). Thus, the history of the sample is a useful adjunct to the table (see Appendix). However, in terms of practical nutrition, for the average individual who eats a good variety of foods, variations in composition are usually not significant. Transportation and refrigeration have enabled most people to include foods from different areas in their diet, and farming and marketing practices have been improved in order to supply the best quality foods to the consumer.

Comparison with Fruits Grown Elsewhere

Because there are many inquiries as to whether the nutritive values of Hawaii-grown fruits are equivalent to those of fruits grown elsewhere, comparisons were made where possible with values published in the *Food Composition Table for Use in Latin America* (*9*) and *Composition of Foods Used in Far Eastern Countries* (*10*). The compilers of these two publications used original analyses, which in their judgment were considered reliable in calculating the representative values.

To make a comparison, an arbitrary means of measuring differences was devised on the basis of the *Recommended Dietary Allowances* (*21*) abbreviated to RDA. For vitamins, differences greater than one-twentieth of the RDA were considered to be nutritionally significant. One-twentieth of the RDA is, for vitamin A, 250 micrograms; thiamine, 0.06 milligram; riboflavin, 0.08 milligram; niacin, 1.0 milligram; and ascorbic acid, 4 milligrams.

For minerals in fruits, differences large enough to rate one source good and another source poor (p. 12) were arbitrarily considered real differences. These were: for both calcium and phosphorus, 15 milligrams; and for iron, 0.5 milligram.

On this basis, the following published values were greater than those found in this study: the calcium content of cherimoya and tangerine; the iron in cactus fruit, Java plum, and ketambilla; and the ascorbic acid in ketambilla and pineapple. Values of Hawaii-grown fruits which were greater than those reported in the literature were as follows: vitamin A value of green sapote, loquat, orange, poha, Surinam cherry, and tangerine; the calcium in tamarind; and the iron in strawberry.

The data presented in this bulletin offer scientific evidence that the nutritive values of fruits grown in Hawaii are comparable to those of fruits grown elsewhere, based on the arbitrary criteria used.

Ascorbic Acid Variation

The variations existing in the nutrient content of different varieties and samples of the same kind of fruit and at different stages of maturity are well illustrated by the ascorbic acid studies on mangos (tables 5, 6, and 7, pp. 66–67).

One variety contained more than 20 times as much ascorbic acid as another variety (table 5). Not only was there variation between varieties, but individual fruits of the same variety showed wide variations (table 6). The data given in table 7 show that all varieties of mangos tested had more ascorbic acid in the green and half-ripe stages than in the ripe. On the other hand, in papayas and pohas, there was an increase in ascorbic acid as the fruit ripened.

SUMMARY AND CONCLUSIONS

About 41 species of fruits were studied, but often a number of horticultural varieties of the same species were analyzed separately so that the total number of samples was about 60. The fruits, of tropical, semitropical, and Asian origin, as well as some common American fruits, were all grown in Hawaii. Nutrients studied were: protein; fat; carbohydrate; three minerals—calcium, phosphorus, and iron; and five vitamins—vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. Percentage of water and the food energy expressed in calories are given.

The analytical methods used and the conversion factors are described. A brief description and the nutritive value of each fruit are given.

The major results are summarized in three tables—in 100-gram quantities for research workers; in household units and common portions for doctors, dietitians, and nutritionists; and in 100-calorie portions for homemakers. For each nutrient studied, there are brief discussions regarding the best sources for each nutrient. For each fruit studied, comparisons are made with values reported in standard tables.

It is reaffirmed that the nutritive values of Hawaii-grown fruits are in general agreement with values reported for fruits grown elsewhere. A number of Hawaii-grown fruits, namely, acerola, common guava, Brewster lychee, and papaya, are superior to citrus fruits as sources of ascorbic acid.

TABLE 1. Composition of Hawaii fruits, per 100 grams of edible portion[1]

ITEM NO.	Fruit	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		per-cent	*calories*	*grams*	*grams*	*grams*
1	Acerola	91.10	31	0.68	0.19	7.58
	Avocado					
2	Beardslee	67.49	233	0.27	25.18	5.80
3	Hulumanu	82.79	103	1.47	9.26	5.69
4	Kahaluu	68.96	221	1.25	23.49	5.56
5	Nabal	69.91	209	1.03	21.80	6.33
	Banana					
	Dessert					
6	Bluefields (Gros Michel)	71.05	102	1.46	0.22	26.47
7	Brazilian ("Apple")	66.94	118	0.87	0.36	31.07
8	Chinese (Cavendish)	79.22	72	1.75	0.18	18.03
9	Lacatan	63.09	130	1.19	0.18	34.55
10	Williams Hybrid	71.33	100	1.08	0.13	26.56
	Plantain (Cooking)					
11	Largo	64.05	127	1.28	0.30	33.50
12	Maiamaoli	67.17	115	0.93	0.04	30.87
13	Popoulu	67.40	114	1.16	0.04	30.36
14	Breadfruit, ripe	61.77	134	0.07	0.18	36.77
15	Cactus Fruit	84.61	53	0.79	0.09	13.76
16	Carambola†	90.23	37	0.85	0.90	7.52
17	Carissa	81.88	68	0.36	0.87	16.45
18	Cherimoya	68.71	110	1.54	0.13	28.95
	Coconut					
19	Cream, prepared with water	65.70	252	3.21	24.88	5.18
20	Cream, prepared without water	53.90	346	4.28	34.68	5.99
21	Water, from nuts with soft spoon-meat	93.78	—	—	—	—
22	Fig	85.73	51	0.69	0.21	12.96
23	Grape, Isabella	82.25	64	0.45	0.19	16.90
24	Grapefruit	91.56	31	0.55	0.30	7.32
25	Green Sapote	69.76	107	1.73	0.47	26.96

[1]See footnotes, page 34.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*micrograms*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.60	0.45	8.7	16.2	0.17	408	0.028	0.082	0.34	2330	1
1.18	1.25	4.7	79.6	0.62	2080	0.039	0.217	0.79	2.3	2
1.55	0.79	7.8	34.1	0.54	—	0.025	0.094	1.23	—	3
1.80	0.70	7.8	21.4	0.40	119	—	—	—	7.5	4
2.02	0.93	10.6	41.9	0.37	802	0.089	0.142	—	5.5	5
0.57	0.80	4.4	23.1	0.27	172*	0.030	0.044	0.70	6	6
0.68	0.76	7.0	30.4	0.28	158	0.041	0.076	0.59	14.6	7
0.25	0.82	2.0	13.4	0.35	82*	0.026	0.041	0.61	8	8
0.31	0.99	6.6	22.5	0.30	77	—	—	—	9.6	9
0.11	0.90	5.0	17.5	0.49	88	0.044	0.045	0.69	5.1	10
0.43	0.87	4.3	20.5	0.54	273	0.038	0.064	0.43	17.5	11
0.31	0.99	3.7	26.3	0.45	388	0.054	0.119	0.65	15.2	12
0.33	1.04	1.2	26.0	0.30	711	0.060	0.071	0.66	14.5	13
1.45	1.21	20.8	48.3	0.26	41*	0.116	0.063	1.54	20.5	14
1.94	0.75	42.8	9.2	0.26	trace	0.015	0.026	0.36	25.4	15
1.47	0.50	0.9	11.1	0.06	21	0.040	0.044	0.71	35	16
0.77	0.44	11.3	7.0	1.31	24	0.037	0.063	0.24	55.5	17
—	0.67	8.9	23.8	0.25	0	0.112	0.112	1.02	12.2	18
—	1.03	16.3	100.0	1.64	0	0.026	trace	0.76	2.8	19
—	1.15	10.7	122.1	2.28	0	0.030	trace	0.89	2.8	20
—	0.41	16.4	13.5	0.07	0	trace	trace	trace	—	21
0.89	0.41	28.3	21.2	0.16	65	0.036	0.039	0.34	2	22
0.20	0.21	7.5	15.9	0.22	104	0.075	0.049	0.19	2	23
0.31	0.27	21.8	16.6	0.09	0	0.052	0.025	0.25	53.9	24
0.11	1.08	34.8	20.3	0.42	730	trace	0.051	1.57	29.2	25

(*Continued*)

TABLE 1. Composition of Hawaii fruits, per 100 grams of edible portion (*Continued*)[1]

ITEM NO.	Fruit	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		per-cent	*calories*	*grams*	*grams*	*grams*
	Guava					
	Cattley					
26	Red, seeds removed	84.31	—	—	—	—
27	Red, whole	81.64	66	0.46	0.38	16.91
28	Yellow, seeds removed	83.40	—	—	—	—
	Common					
29	Seeds removed‡	84.35	55	0.28	(0.1)	14.79
30	Whole	81.75	65	0.75	0.24	16.76
31	Java Plum	84.76	54	0.60	0.07	14.24
	Ketambilla					
32	Pulp	86.39	47	1.50	0.13	11.42
33	Whole	86.01	—	—	—	—
34	Lime, juice	90.86	24	0.53	0.01	8.33
35	Loquat	87.26	47	0.52	0.64	11.10
	Lychee					
36	Brewster	80.96	68	0.75	0.22	17.70
37	Kwai Mi	77.63	80	0.94	0.29	20.77
38	Macadamia Nut, cooked	1.19	727	9.23	78.21	9.97
	Mango					
39	Haden	84.12	56	0.39	0.02	15.05
40	Pirie	79.97	72	0.55	0.20	18.91
41	Mountain Apple	91.54	30	0.33	0.06	7.81
42	Mulberry	86.91	46	1.44	0.39	10.57
43	Ohelo Berry	90.07	36	0.38	0.22	9.07
44	Orange	89.38	37	0.55	0.08	9.66
	Papaya, Solo					
45	Hermaphrodite	86.80	46	0.39	0.06	12.18
46	Pistillate	86.25	48	0.40	0.08	12.70
	Passion Fruit					
47	Purple, juice	85.62	51	0.39	0.05	13.60
48	Yellow, juice	84.94	53	0.67	0.18	13.72

[1]See footnotes, page 34.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*micro-grams*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
—	—	—	—	—	145	0.034	0.029	0.64	33	26
6.06	0.61	34.4	19.7	0.27	—	—	—	—	—	27
—	—	—	—	—	trace	0.029	0.031	0.42	21.0	28
2.38	0.48	14.6	15.5	0.29	109	0.056	0.060	1.28	100	29
6.84	0.50	9.5	21.6	1.49	—	0.037	0.053	0.61	70–350	30
1.72	0.33	2.0	13.4	0.27	0	trace	—	0.24	31	31
0.13	0.56	8.2	12.0	0.45	—	—	—	—	—	32
—	—	—	—	—	237	0.012	0.052	0.25	66.3	33
0.05	0.27	9.4	8.5	0.11	—	0.020	0.034	0.23	25.1*	34
0.83	0.48	9.3	10.9	0.14	1122	0.019	0.024	0.18	trace	35
0.54	0.37	10.4	22.3	0.16	0	0.015	0.060	0.69	80.8*	36
0.16	0.37	3.9	34.6	0.37	0	0.035	0.084	1.91	40.2	37
1.84	1.40	53.4	240.8	1.99	0	0.216	0.119	1.60	—	38
0.54	0.42	8.1	10.4	0.16	3813*	0.041	0.057	0.30	15.1	39
0.70	0.37	6.0	14.7	0.16*	4735*	0.081	0.060	0.46	15	40
0.80	0.26	7.0	13.0	0.38	0	0.029	0.036	0.24	23.4*	41
0.96	0.69	39.4	38.0	1.85	15	0.029	0.101	0.62	36.4	42
1.32	0.26	7.2	10.1	0.09	498	0.017	0.036	0.27	6	43
0.18	0.33	23.1	20.5	0.20	646	0.104	0.086	0.34	50.5	44
0.58	0.57	29.9	11.6	0.19	1093	0.027	0.043	0.33	84	45
0.60	0.57	40.9	15.5	0.21	2034	0.020	0.040	0.39	74.1	46
0.04	0.34	3.6	12.5	0.24	717	trace	0.131	1.46	29.8	47
0.17	0.49	3.8	24.6	0.36	2410	trace	0.101	2.24	20	48

(*Continued*)

TABLE 1. Composition of Hawaii fruits, per 100 grams of edible portion (*Continued*)[1]

ITEM NO.	Fruit	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		per cent	*calories*	*grams*	*grams*	*grams*
49	Persimmon, Hachiya	78.67	76	0.53	0.15	20.31
50	Pineapple, Smooth Cayenne	85.54	52	0.45	0.21	13.51
51	Plum, Methley	88.70	40	0.55	0.06	10.42
52	Poha	81.57	64	1.93	0.15	15.49
53	Pummelo or Shaddock	89.94	34	0.76	0.04	8.78
54	Roselle	90.96	34	0.96	0.64	6.93
	Soursop					
55	Juice	82.18	—	—	—	—
56	Pulp	80.11	71	0.69	0.39	18.23
57	Strawberry	90.51	33	0.76	0.18	8.12
58	Surinam Cherry	89.03	39	0.46	0.05	10.22
59	Sweetsop	75.97	86	1.89	0.57	20.82
60	Tamarind	33.89	230	3.28	0.50	59.76
61	Tangerine	90.13	34	0.71	0.05	8.78
	Watermelon					
62	Charleston Gray	92.64	26	0.51	0.05	6.54
63	Chilean Black Seeded	90.20	34	0.90	0.11	8.42
64	Wi-apple	85.94	50	0.53	0.28	12.83

[1]Note: "Trace" indicates that values were less than (<) 10 micrograms for vitamin A value; < 0.010 milligram for thiamine and riboflavin; < 0.10 milligram for niacin; < 1 milligram for ascorbic acid.

"0" in the vitamin A value column indicates that in the absence of any yellow pigment it was assumed that no carotene or other usable carotenoid pigments were present.

"—" indicates that no determinations were made.

Figure in parentheses (p. 32, fat for guava) was estimated in order to supply a carbohydrate figure.

* Moisture content not determined, but assumed to be similar to value given in moisture column.

† Minerals determined on juice; other nutrients on pulp

‡ Vitamin values are for mixed seedling types; vitamin A value varies with color; typical ascorbic acid value given.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*micrograms*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.34	0.34	5.9	19.0	0.17	985	trace	0.060	0.18	7.3	49
0.50	0.29	18.4	11.5	0.26	trace	0.085	0.036	0.24	10.1	50
0.89	0.27	5.1	12.6	0.14	85	0.012	0.033	0.37	3.2	51
3.17	0.87	7.2	47.4	0.93	1598*	0.166	0.051	1.78*	42	52
0.18	0.48	7.4	20.8	0.15	0	0.034	0.027	0.22	39.9	53
1.14	0.51	—	—	—	172	0.011	0.028	0.31	12.0	54
—	—	—	—	—	0	0.067	0.120	1.52	16.4	55
0.95	0.58	8.8	29.0	0.82	—	—	—	—	—	56
0.98	0.43	20.9	29.4	2.54	11	0.020	0.040	0.27	62.2	57
0.33	0.24	6.6	8.7	0.14	1120	0.024	0.054	0.23	18.8	58
1.41	0.75	17.0	53.6	0.30	0	0.104	0.057	0.89	35.9	59
1.79	2.57	113.5	95.4	0.60	0	0.154	0.216	1.28	trace	60
0.02	0.33	13.6	13.0	0.21	830	0.105	0.022	0.16	30.8	61
0.05	0.26	1.3	7.0	0.20	179	0.040	0.018	—	7.3	62
0.10	0.37	6.2	17.0	0.17	464	0.038	0.040	0.20	6	63
0.83	0.42	10.1	21.6	0.31	360*	0.052	0.015	1.33	50.6*	64

TABLE 2. Composition of Hawaii fruits, in household units and common portions*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Acerola						
1	1 medium, 7/8″×7/8″ AP, pitted	6	91.10	2	0.04	0.01	0.45
2	1 cup, medium AP	122	91.10	30	0.67	0.19	7.43
	Avocado, Beardslee						
3	½ small, 4″×3⅞″ AP, peeled and pitted	167	67.49	389	0.45	42.05	9.69
4	½ medium, 4¾″×4″ AP, peeled and pitted	202	67.49	471	0.55	50.86	11.72
5	½ large, 5″×4⅜″ AP, peeled and pitted	249	67.49	580	0.67	62.70	14.44
6	1 cup, ½″ cubes	150	67.49	350	0.40	37.77	8.70
7	1 cup, pulp	230	67.49	536	0.62	57.91	13.34
	Avocado, Hulumanu						
8	½ medium, 7″ length AP, peeled and pitted	222	82.79	229	3.26	20.56	12.63
	Avocado, Kahaluu						
9	½ small, 3⅞″×3¼″ AP, peeled and pitted	131	68.96	290	1.64	30.77	7.28
10	½ medium, 4″×3½″ AP, peeled and pitted	152	68.96	336	1.90	35.70	8.45
11	½ large, 4⅝″×3⅝″ AP, peeled and pitted	186	68.96	411	2.32	43.69	10.34
12	1 cup, ½″ cubes	150	68.96	332	1.88	35.24	8.34
13	1 cup, pulp	225	68.96	497	2.81	52.85	12.51
	Avocado, Nabal						
14	½ medium, 4¼″×4″ AP, peeled and pitted	217	69.91	454	2.24	47.31	13.74
	Banana, Bluefields (Gros Michel)						
15	1 small, 5⅜″×1½″ AP, peeled	79	71.05	81	1.15	0.17	20.91
16	1 medium, 6½″×1⅜″ AP, peeled	117	71.05	119	1.71	0.26	30.97
17	1 large, 8¼″×1⅜″ AP, peeled	145	71.05	148	2.12	0.32	38.38
18	1 cup, ¼″ slices	153	71.05	156	2.23	0.34	40.50
19	1 cup, pulp	225	71.05	230	3.28	0.50	59.56
	Banana, Brazilian ("Apple")						
20	1 small, 4¾″×1½″ AP, peeled	54	66.94	64	0.47	0.19	16.78
21	1 medium, 5¾″×1¾″ AP, peeled	70	66.94	83	0.61	0.25	21.75
22	1 large, 6⅞″×1¾″ AP, peeled	130	66.94	153	1.13	0.47	40.39
23	1 cup, ¼″ slices	140	66.94	165	1.22	0.50	43.50

* See footnotes, page 48.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
0.04	0.03	0.5	1.0	0.01	24	trace	trace	trace	140	1
0.59	0.44	8.5	15.9	0.17	400	0.027	0.080	0.33	2283	2
1.97	2.09	7.8	132.9	1.04	3474	0.065	0.362	1.32	3.8	3
2.38	2.52	9.5	160.8	1.25	4202	0.079	0.438	1.60	4.6	4
2.94	3.11	11.7	198.2	1.54	5179	0.097	0.540	1.97	5.7	5
1.77	1.88	7.0	119.4	0.93	3120	0.058	0.326	1.18	3.4	6
2.71	2.88	10.8	183.1	1.43	4784	0.090	0.499	1.82	5.3	7
3.44	1.75	17.3	75.7	1.20	—	0.056	0.209	2.73	—	8
2.36	0.92	10.2	28.0	0.52	156	—	—	—	9.8	9
2.74	1.06	11.9	32.5	0.61	181	—	—	—	11.4	10
3.35	1.30	14.5	39.8	0.74	221	—	—	—	14.0	11
2.70	1.05	11.7	32.1	0.60	179	—	—	—	11.2	12
4.05	1.58	17.6	48.2	0.90	268	—	—	—	16.9	13
4.38	2.02	23.0	90.9	0.80	1740	0.193	0.308	—	11.9	14
0.45	0.63	3.5	18.2	0.21	136	0.024	0.035	0.55	5	15
0.67	0.94	5.1	27.0	0.32	201	0.035	0.051	0.82	7	16
0.83	1.16	6.4	33.5	0.39	249	0.044	0.064	1.02	9	17
0.87	1.22	6.7	35.3	0.41	263	0.046	0.067	1.07	9	18
1.28	1.80	9.9	52.0	0.61	387	0.068	0.099	1.58	14	19
0.37	0.41	3.8	16.4	0.15	85	0.022	0.041	0.32	7.9	20
0.48	0.53	4.9	21.3	0.20	111	0.029	0.053	0.41	10.2	21
0.88	0.99	9.1	39.5	0.36	205	0.053	0.099	0.77	19.0	22
0.95	1.06	9.8	42.6	0.39	221	0.057	0.106	0.83	20.4	23

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions (*Continued*)

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Banana, Chinese (Cavendish)						
24	1 small, 4¾″×1¼″ AP, peeled	50	79.22	36	0.88	0.09	9.02
25	1 medium, 5¼″×1½″ AP, peeled	63	79.22	45	1.10	0.11	11.36
26	1 large, 7″×1½″ AP, peeled	80	79.22	58	1.40	0.14	14.42
27	1 cup, ¼″ slices	142	79.22	102	2.48	0.26	25.60
28	1 cup, pulp	165	79.22	119	2.89	0.30	29.75
	Banana, Lacatan						
29	1 medium, 6″×1½″ AP, peeled	110	63.09	143	1.31	0.20	38.00
	Banana, Williams Hybrid						
30	1 medium, 6½″×1¾″ AP, peeled	137	71.33	137	1.48	0.18	36.39
	Banana (Plantain), Largo						
31	1 medium, 7″×2½″ AP, peeled	140	64.05	178	1.79	0.42	46.90
	Banana (Plantain), Maiamaoli						
32	1 medium, 7½″×2⅞″ AP, peeled	236	67.17	271	2.19	0.09	72.85
	Banana (Plantain), Popoulu						
33	1 medium, 5⅝″×2½″ AP, peeled	238	67.40	271	2.76	0.10	72.26
	Breadfruit, ripe						
34	¼ small, 4⅜″×4⅛″ AP, peeled	96	61.77	129	0.07	0.17	35.30
35	⅛ medium, 5¾″×5¼″ AP, peeled	100	61.77	134	0.07	0.18	36.77
36	1 cup, pulp	220	61.77	295	0.15	0.40	80.89
	Cactus Fruit						
37	1 medium, 3¼″×2⅜″ AP, peeled	143	84.61	76	1.13	0.13	19.68
	Carambola[2]						
38	1 medium, 5″×3″ AP, seeds removed	193	90.23	71	1.64	1.74	14.51
	Carissa						
39	1 medium, 1½″×1⅛″ AP, seeds removed	13	81.88	9	0.05	0.11	2.14
40	1 cup, ⅛″ slices	150	81.88	102	0.54	1.30	24.68

* See footnotes, page 48.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.12	0.41	1.0	6.7	0.18	41	0.013	0.020	0.30	4	24
0.16	0.52	1.3	8.4	0.22	52	0.016	0.026	0.38	5	25
0.20	0.66	1.6	10.7	0.28	66	0.021	0.033	0.49	6	26
0.36	1.16	2.8	19.0	0.50	116	0.037	0.058	0.87	11	27
0.41	1.35	3.3	22.1	0.58	135	0.043	0.068	1.01	13	28
0.34	1.09	7.3	24.8	0.33	85	—	—	—	10.6	29
0.15	1.23	6.8	24.0	0.67	121	0.060	0.062	0.95	7.0	30
0.60	1.22	6.0	28.7	0.76	382	0.053	0.090	0.60	24.5	31
0.73	2.34	8.7	62.1	1.06	916	0.127	0.281	1.53	35.9	32
0.79	2.48	2.9	61.9	0.71	1692	0.143	0.169	1.57	34.5	33
1.39	1.16	20.0	46.4	0.25	39	0.111	0.060	1.48	19.7	34
1.45	1.21	20.8	48.3	0.26	41	0.116	0.063	1.54	20.5	35
3.19	2.66	45.8	106.3	0.57	90	0.255	0.139	3.39	45.1	36
2.77	1.07	61.2	13.2	0.37	trace	0.021	0.037	0.51	36.3	37
2.84	0.96	1.7	21.4	0.12	41	0.077	0.085	1.37	68	38
0.10	0.06	1.5	0.9	0.17	trace	trace	trace	trace	7.2	39
1.16	0.66	17.0	10.5	1.96	36	0.056	0.094	0.36	83.2	40

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions (*Continued*)

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Cherimoya						
41	1 large, 5″×3⅞″ AP, peeled and seeds removed	547	68.71	602	8.42	0.71	158.36
	Coconut Cream						
42	prepared with water 1 cup	229	65.70	577	7.35	56.98	11.86
	Coconut Cream						
43	prepared without water 1 cup	232	53.90	803	9.93	80.46	13.90
	Coconut Water						
44	from nuts with soft spoon-meat 1 cup	284	93.78	—	—	—	—
	Fig						
45	1 medium, 2¼″×2″ AP	52	85.73	27	0.36	0.11	6.74
46	1 large, 2½″×2¼″ AP	70	85.73	36	0.48	0.15	9.07
	Grape, Isabella						
47	1 cup, skin and seeds removed	286	82.25	183	1.29	0.54	48.33
48	1 cup, whole AP	153	82.25	67	0.47	0.20	17.58
	Grapefruit						
49	1 medium, 2¾″×3½″ AP, peeled and membranes removed	134	91.56	42	0.74	0.40	9.81
50	½ medium AP	110	91.56	21	0.37	0.20	4.90
51	1 cup, sections, membranes removed	202	91.56	63	1.11	0.61	14.79
	Green Sapote						
52	1 medium, 4″×3¾″ AP, peeled and seeds removed	225	69.76	241	3.89	1.06	60.66
	Guava, Cattley, Red[3]						
53	1 medium, ¾″×⅞″ AP	5	81.64	3	0.02	0.02	0.85
54	1 cup pulp and shell, seeds removed	244	84.31	161	1.12	0.93	41.26
	Guava, Cattley, Yellow						
55	1 medium, ⅞″×1″ AP, seeds removed	8	83.40	—	—	—	—
56	1 cup pulp and shell, seeds removed	244	83.40	—	—	—	—

* See footnotes, page 48.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
—	3.66	48.7	130.2	1.37	0	0.613	0.613	5.58	66.7	41
—	2.36	37.3	229.0	3.76	0	0.060	trace	1.74	6.4	42
—	2.67	24.8	283.3	5.29	0	0.070	trace	2.06	6.5	43
—	1.16	46.6	38.3	0.20	0	trace	trace	trace	—	44
0.46	0.21	14.7	11.0	0.08	34	0.019	0.020	0.18	1	45
0.62	0.29	19.8	14.8	0.11	46	0.025	0.027	0.24	1	46
0.57	0.60	21.4	45.5	0.63	297	0.214	0.140	0.54	6	47
0.21	0.22	7.8	16.5	0.23	108	0.078	0.051	0.20	2	48
0.42	0.36	29.2	22.2	0.12	0	0.070	0.034	0.34	72.2	49
0.21	0.18	14.6	11.1	0.06	0	0.035	0.017	0.17	36.1	50
0.63	0.55	44.0	33.5	0.18	0	0.105	0.050	0.50	108.9	51
0.25	2.43	78.3	45.7	0.95	1642	trace	0.115	3.53	65.7	52
0.30	0.03	1.7	1.0	0.01	trace	trace	trace	trace	2	53
—	—	—	—	—	354	0.083	0.071	1.56	81	54
—	—	—	—	—	trace	trace	trace	trace	1.7	55
—	—	—	—	—	trace	0.071	0.076	1.02	51.2	56

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions (*Continued*)

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Guava, Common						
57	1 medium, 2½″×2¼″ AP	112	81.75	73	0.84	0.27	18.77
58	1 medium, 2½″×2¼″ AP, seeds removed[4]	90	84.35	50	0.25	(0.1)	13.31
59	1 cup, pulp and shell, seeds removed[4]	165	84.35	91	0.46	(0.2)	24.40
	Java Plum						
60	1 cup, pitted	135	84.76	73	0.81	0.09	19.22
	Ketambilla[5]						
61	1 cup, pulp	234	86.39	110	3.51	0.30	26.72
62	1 cup, whole	128	86.01	60	1.92	0.17	14.62
	Lime, juice						
63	1 cup	250	90.86	60	1.32	0.02	20.82
	Loquat						
64	1 medium, 2¼″×1¾″ AP, peeled and pitted	25	87.26	12	0.13	0.16	2.78
	Lychee, Brewster						
65	1 medium, 1½″×1¼″ AP, peeled and pitted	13	80.96	9	0.10	0.03	2.30
66	1 cup, peeled and pitted	190	80.96	129	1.42	0.42	33.63
	Lychee, Kwai Mi						
67	1 medium, 1⅜″×1⅛″ AP, peeled and pitted	11	77.63	9	0.10	0.03	2.28
68	1 cup, peeled and pitted	190	77.63	152	1.79	0.55	39.46
	Macadamia Nut, cooked						
69	1 small, ⅝″×⅝″	2	1.19	15	0.18	1.56	0.20
70	1 medium, ⅝″×⅞″	4	1.19	29	0.37	3.13	0.40
71	1 large, ¾″×1″	6	1.19	44	0.55	4.69	0.60
72	1 cup	134	1.19	974	12.37	104.80	13.36
	Mango, Haden						
73	1 small, 3⅜″×3″ AP, peeled and pitted	174	84.12	97	0.68	0.03	26.19
74	1 medium, 3⅝″×3¼″ AP, peeled and pitted	228	84.12	128	0.89	0.05	34.31
75	1 large, 4″×3½″ AP, peeled and pitted	295	84.12	165	1.15	0.06	44.40
76	1 cup, ½″ cubes	170	84.12	95	0.66	0.03	25.58

* See footnotes, page 48.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
7.66	0.56	10.6	24.2	1.67	—	0.041	0.059	0.68	78–392	57
2.14	0.43	13.1	14.0	0.26	98	0.050	0.054	1.15	90	58
3.93	0.79	24.1	25.6	0.48	180	0.092	0.099	2.11	165	59
2.32	0.45	2.7	18.1	0.36	0	trace	—	0.32	36	60
0.30	1.31	19.2	28.1	1.05	555	0.028	0.122	0.58	155.1	61
—	—	—	—	—	303	0.015	0.067	0.32	84.9	62
0.12	0.68	23.5	21.2	0.28	—	0.050	0.085	0.58	62.8	63
0.21	0.12	2.3	2.7	0.04	280	trace	trace	trace	trace	64
0.07	0.05	1.4	2.9	0.02	0	trace	trace	trace	10.5	65
1.03	0.70	19.8	42.4	0.30	0	0.028	0.114	1.31	153.5	66
0.02	0.04	0.4	3.8	0.04	0	trace	trace	0.21	4.4	67
0.30	0.70	7.4	65.7	0.70	0	0.066	0.160	3.63	76.4	68
0.04	0.03	1.1	4.8	0.04	0	trace	trace	trace	—	69
0.07	0.06	2.1	9.6	0.08	0	trace	trace	trace	—	70
0.11	0.08	3.2	14.4	0.12	0	0.013	trace	trace	—	71
2.47	1.88	71.6	322.7	2.67	0	0.289	0.159	2.14	—	72
0.94	0.73	14.1	18.1	0.28	6635	0.071	0.099	0.52	26.3	73
1.23	0.96	18.5	23.7	0.36	8694	0.093	0.130	0.68	34.4	74
1.59	1.24	23.9	30.7	0.47	11248	0.121	0.168	0.88	44.5	75
0.92	0.71	13.8	17.7	0.27	6482	0.070	0.097	0.51	25.7	76

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Mango, Pirie						
77	1 small, 2⅝″×2¾″ AP, peeled and pitted	112	79.97	81	0.62	0.22	21.18
78	1 medium, 3⅛″×3⅛″ AP, peeled and pitted	172	79.97	124	0.95	0.34	32.53
79	1 large, 3⅜″×3⅜″ AP, peeled and pitted	238	79.97	171	1.31	0.48	45.01
80	1 cup, ½″ cubes	160	79.97	115	0.88	0.32	30.26
	Mountain Apple						
81	1 medium, 2″×1⅞″ AP, pitted	56	91.54	17	0.18	0.03	4.37
82	1 cup, ½″ cubes	147	91.54	44	0.49	0.09	11.48
	Mulberry						
83	1 cup	140	86.91	64	2.02	0.55	14.80
	Ohelo Berry						
84	1 cup	140	90.07	50	0.53	0.31	12.70
	Orange						
85	1 small, 2⅝″×2¾″ AP, peeled and membranes removed	96	89.38	36	0.53	0.08	9.27
86	1 medium, 3″×3″ AP, peeled and membranes removed	135	89.38	50	0.74	0.11	13.04
87	1 large, 3½″×3⅜″ AP, peeled and membranes removed	219	89.38	81	1.20	0.18	21.16
88	1 cup, sections	190	89.38	70	1.04	0.15	18.35
	Papaya, Solo, Hermaphrodite						
89	½ small, 4⅜″×3½″ AP, skin and seeds removed	97	86.80	45	0.38	0.06	11.81
90	½ medium, 5″×4″ AP, skin and seeds removed	144	86.80	66	0.56	0.09	17.54
91	½ large, 5⅛″×4⅜″ AP, skin and seeds removed	202	86.80	93	0.79	0.12	24.60
92	1 cup, ½″ cubes	140	86.80	64	0.55	0.08	17.05
93	1 cup, pulp	232	86.80	107	0.90	0.14	28.26
	Papaya, Solo, Pistillate						
94	½ medium, 4½″×4¼″ AP, skin and seeds removed	230	86.25	110	0.92	0.18	29.21
	Passion Fruit, Purple, juice						
95	1 cup	247	85.62	126	0.96	0.12	33.59

* See footnotes, page 48.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.78	0.41	6.7	16.5	0.18	5303	0.091	0.067	0.52	17	77
1.20	0.64	10.3	25.3	0.28	8144	0.139	0.103	0.79	26	78
1.67	0.88	14.3	35.0	0.38	11269	0.193	0.143	1.09	36	79
1.12	0.59	9.6	23.5	0.26	7576	0.130	0.096	0.74	24	80
0.45	0.15	3.9	7.3	0.21	0	0.016	0.020	0.13	13.1	81
1.18	0.38	10.3	19.1	0.56	0	0.043	0.053	0.35	34.4	82
1.34	0.97	55.2	53.2	2.59	21	0.041	0.141	0.87	51.0	83
1.85	0.36	10.1	14.1	0.13	697	0.024	0.050	0.38	8	84
0.17	0.32	22.2	19.7	0.19	620	0.100	0.083	0.33	48.5	85
0.24	0.45	31.2	27.7	0.27	872	0.140	0.116	0.46	68.2	86
0.39	0.72	50.6	44.9	0.44	1415	0.228	0.188	0.74	110.6	87
0.34	0.63	43.9	39.0	0.38	1227	0.198	0.163	0.65	96.0	88
0.56	0.55	29.0	11.3	0.18	1060	0.026	0.042	0.32	81	89
0.84	0.82	43.1	16.7	0.27	1574	0.039	0.062	0.48	121	90
1.17	1.15	60.4	23.4	0.38	2208	0.055	0.087	0.67	170	91
0.81	0.80	41.9	16.2	0.27	1530	0.038	0.060	0.46	118	92
1.35	1.32	69.4	26.9	0.44	2536	0.063	0.100	0.77	195	93
1.38	1.31	94.1	35.6	0.48	4678	0.046	0.092	0.90	170.4	94
0.10	0.84	8.9	30.9	0.59	1771	trace	0.324	3.61	73.6	95

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions *(Continued)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*calories*	*grams*	*grams*	*grams*
	Passion Fruit, Yellow, juice						
96	1 cup	247	84.94	131	1.65	0.44	33.89
	Persimmon, Hachiya						
97	1 medium, 2½″×2½″ AP, peeled	136	78.67	103	0.72	0.20	27.62
	Pineapple, Smooth Cayenne						
98	1 wedge, ⅛ of medium, 7″ × 5¼″ AP, peeled and cored	148	85.54	77	0.67	0.31	19.99
99	1 slice of medium, ⅝″ thick, peeled and cored	159	85.54	83	0.72	0.33	21.48
100	1 cup, ½″ cubes	170	85.54	88	0.76	0.36	22.97
	Plum, Methley						
101	1 medium, 1¾″×1¾″ AP, pitted	46	88.70	18	0.25	0.03	4.79
102	1 cup, slices	162	88.70	65	0.89	0.10	16.88
	Poha						
103	1 cup, husks removed	140	81.57	90	2.70	0.21	21.69
	Pummelo or Shaddock						
104	1 medium, 5½″×5½″ AP, peeled and membranes removed	609	89.94	207	4.63	0.24	53.47
105	1 cup, sections	190	89.94	65	1.44	0.08	16.68
	Roselle						
106	1 cup, whole AP	57	90.96	12	0.34	0.22	2.43
	Soursop[6]						
107	1 medium, 7″×5¼″ AP, peeled and strained	625	82.18	444	4.31	2.44	113.94
108	1 cup, pulp	225	80.11	160	1.55	0.88	41.02
	Strawberry						
109	1 cup	150	90.51	50	1.14	0.27	12.18
	Surinam Cherry						
110	1 medium, ⅞″×1⅛″ AP, pitted	6	89.03	2	0.03	trace	0.61
111	1 cup, pitted	172	89.03	67	0.79	0.09	17.58
	Sweetsop						
112	1 medium, 2⅞″×3¼″ AP, peeled and seeds removed	155	75.97	133	2.93	0.88	32.27
113	1 cup, pulp	250	75.97	215	4.72	1.42	52.05

* See footnotes, page 48.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
0.42	1.21	9.4	60.8	0.89	5953	trace	0.249	5.53	49	96
0.46	0.46	8.0	25.8	0.23	1340	trace	0.082	0.24	9.9	97
0.74	0.43	27.2	17.0	0.38	trace	0.126	0.053	0.36	14.9	98
0.80	0.46	29.3	18.3	0.41	trace	0.135	0.057	0.38	16.1	99
0.85	0.49	31.3	19.6	0.44	trace	0.144	0.061	0.41	17.2	100
0.41	0.12	2.3	5.8	0.06	39	trace	0.015	0.17	1.5	101
1.44	0.44	8.3	20.4	0.23	138	0.019	0.053	0.60	5.2	102
4.44	1.22	10.1	66.4	1.30	2237	0.232	0.071	2.49	59	103
1.10	2.92	45.1	126.7	0.91	0	0.207	0.164	1.34	243.0	104
0.34	0.91	14.1	39.5	0.28	0	0.065	0.051	0.42	75.8	105
0.40	0.18	—	—	—	60	trace	0.010	0.11	4.2	106
—	—	55.0	181.2	5.12	0	0.419	0.750	9.50	102.5	107
2.14	1.30	19.8	65.2	1.84	0	0.151	0.270	3.42	36.9	108
1.47	0.64	31.4	44.1	3.81	16	0.030	0.060	0.40	93.3	109
0.02	0.01	0.4	0.5	0.01	67	trace	trace	trace	1.1	110
0.57	0.41	11.4	15.0	0.24	1926	0.041	0.093	0.40	32.3	111
2.19	1.16	26.4	83.1	0.46	0	0.161	0.088	1.38	55.6	112
3.52	1.88	42.5	134.0	0.75	0	0.260	0.142	2.22	89.8	113

(*Continued*)

TABLE 2. Composition of Hawaii fruits, in household units and common portions (*Continued*)

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Food Energy	Protein	Fat	Total Carbohydrate
			per-cent	*calories*	*grams*	*grams*	*grams*
	Tamarind						
114	1 medium, 3″×1″ AP, peeled and seeds removed	2	33.89	5	0.07	0.01	1.20
115	1 cup, pulp	120	33.89	276	3.94	0.60	71.71
	Tangerine						
116	1 medium, 1¾″×2⅜″ AP, peeled and membranes removed	91	90.13	31	0.65	0.05	7.99
117	1 cup, sections	192	90.13	65	1.36	0.10	16.86
	Watermelon, Charleston Gray						
118	1 wedge, 1/16 of 18½″×8¼″ melon AP, rind removed	520	92.64	135	2.65	0.26	34.01
119	1 cup, ½″ cubes	150	92.64	39	0.76	0.08	9.81
	Watermelon, Chilean Black Seeded						
120	1 wedge, 1/16 of 9¼″×9½″ melon AP, rind removed	260	90.20	88	2.34	0.29	21.89
121	1 cup, ½″ cubes	150	90.20	51	1.35	0.16	12.63
	Wi-apple						
122	1 medium, 2¾″×2½″ AP, peeled, pitted, and fibers removed	96	85.94	48	0.51	0.27	12.32

*Note: "Trace" indicates that values were less than (<) 10 International Units for vitamin A value; < 0.010 milligram for thiamine and riboflavin; < 0.10 milligram for niacin; < 1 milligram for ascorbic acid.

"0" in the vitamin A value column indicates that in the absence of any yellow pigment it was assumed that no carotene or other usable carotenoid pigments were present.

"—" indicates that no determinations were made.

Figures in parentheses (p. 42, fat for guava) were estimated in order to supply a carbohydrate figure.

[1] The size of the fruits, shown as length times diameter in inches, includes the skin, i.e., as purchased, abbreviated AP. The weight and nutritive values are for the edible portion of the fruit as described, i.e., peeled and pitted, or ½″ cubes, etc., with a few exceptions. See page 27.

[2] Minerals determined on juice; other nutrients on pulp.

[3] Vitamin values determined on fruit with seeds removed; other values on whole fruit.

[4] Vitamin values are averages for mixed seedling types; vitamin A value varies with color; typical ascorbic acid value given.

[5] Vitamin values determined on whole fruit; other values on pulp.

[6] Vitamin values determined on pulp; other values on juice.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.04	0.05	2.3	1.9	0.01	0	trace	trace	trace	trace	114
2.15	3.08	136.2	114.5	0.72	0	0.185	0.259	1.54	trace	115
0.02	0.30	12.4	11.8	0.19	755	0.096	0.020	0.15	28.0	116
0.04	0.63	26.1	25.0	0.40	1594	0.202	0.042	0.31	59.1	117
0.26	1.35	6.8	36.4	1.04	931	0.208	0.094	—	38.0	118
0.08	0.39	2.0	10.5	0.30	268	0.060	0.027	—	11.0	119
0.26	0.96	16.1	44.2	0.44	1206	0.099	0.104	0.52	16	120
0.15	0.56	9.3	25.5	0.26	696	0.057	0.060	0.30	9	121
0.80	0.40	9.7	20.7	0.30	346	0.050	0.014	1.28	48.6	122

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
1	Acerola	322	91.10	2.19	0.61	24.41
	54 medium, ⅞″×⅞″ AP, pitted					
	3⅓ cups, medium AP					
2	Avocado, Beardslee	43	67.49	0.12	10.83	2.49
	⅛ small, 4″×3⅞″ AP, peeled and pitted					
	⅓ cup, ½″ cubes					
	3 tablespoons, pulp					
3	Avocado, Hulumanu	97	82.79	1.43	8.98	5.52
	¼ medium, 7″ length AP, peeled and pitted					
4	Avocado, Kahaluu	45	68.96	0.56	10.57	2.50
	⅛ large, 4⅝″×3⅝″ AP, peeled and pitted					
	⅓ cup, ½″ cubes					
	3 tablespoons, pulp					
5	Avocado, Nabal	48	69.91	0.49	10.46	3.04
	⅛ medium, 4¼″×4″ AP, peeled and pitted					
6	Banana, Bluefields (Gros Michel)	98	71.05	1.43	0.22	25.94
	1¼ small, 5⅜″×1½″ AP, peeled					
	¾ medium, 6½″×1⅝″ AP, peeled					
	⅔ large, 8¼″×1⅝″ AP, peeled					
	⅔ cup, ¼″ slices					
	½ cup, pulp					
7	Banana, Brazilian ("Apple")	85	66.94	0.74	0.31	26.41
	1½ small, 4¾″×1½″ AP, peeled					
	1¼ medium, 5¾″×1¾″ AP, peeled					
	⅔ large, 6⅞″×1¾″ AP, peeled					
	⅔ cup, ¼″ slices					
8	Banana, Chinese (Cavendish)	139	79.22	2.43	0.25	25.06
	2¾ small, 4¾″×1¼″ AP, peeled					
	2¼ medium, 5¼″×1½″ AP, peeled					
	1¾ large, 6″×1½″ AP, peeled					
	1 cup, ¼″ slices					
	¾ cup, pulp					

* See footnotes, page 62.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
1.93	1.45	28.0	52.2	0.55	1314	0.090	0.264	1.09	7503	1
0.51	0.54	2.0	34.2	0.27	894	0.017	0.093	0.34	1.0	2
1.50	0.77	7.6	33.1	0.52	—	0.024	0.091	1.19	—	3
0.81	0.32	3.5	9.6	0.18	54	—	—	—	3.4	4
0.97	0.45	5.1	20.1	0.18	385	0.043	0.068	—	2.6	5
0.56	0.78	4.3	22.6	0.26	169	0.029	0.043	0.69	6	6
0.58	0.65	6.0	25.8	0.24	134	0.035	0.065	0.50	12.4	7
0.35	1.14	2.8	18.6	0.49	114	0.036	0.057	0.85	11	8

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
9	Banana, Lacatan ⅔ medium, 7″×1½″ AP, peeled	77	63.09	0.92	0.14	26.60
10	Banana, Williams Hybrid ¾ medium, 6½″×1 ″ AP, peeled	100	71.33	1.08	0.13	26.56
11	Banana (Plantain), Largo ½ medium, 7″×2½″ AP, peeled	79	64.05	1.01	0.24	26.46
12	Banana (Plantain), Maiamaoli ⅓ medium, 7½″×2⅞″ AP, peeled	87	67.17	0.81	0.03	26.86
13	Banana (Plantain), Popoulu ⅓ medium, 5⅜″×2½″ AP, peeled	88	67.40	1.02	0.04	26.72
14	Breadfruit, ripe ¼ small, 4⅜″×4⅛″ AP, peeled ⅓ cup, pulp	75	61.77	0.05	0.14	27.58
15	Cactus Fruit 1⅓ medium, 3¼″×2⅜″ AP, peeled	189	84.61	1.49	0.17	26.01
16	Carambola[2] 1⅓ medium, 5″×3″ AP, seeds removed	270	90.23	2.30	2.43	20.30
17	Carissa 11 medium, 1½″×1⅛″ AP, seeds removed 1 cup, ⅛″ slices	147	81.88	0.53	1.28	24.18
18	Cherimoya ⅙ large, 5″×3⅞″ AP, peeled and seeds removed	91	68.71	1.40	0.12	26.34
19	Coconut Cream prepared with water 3 tablespoons	40	65.70	1.28	9.95	2.07
20	Coconut Cream prepared without water 2 tablespoons	29	53.90	1.24	10.06	1.74

* See footnotes, page 62.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
0.24	0.76	5.1	17.3	0.23	59	—	—	—	7.4	9
0.11	0.90	5.0	17.5	0.49	88	0.044	0.045	0.69	5.1	10
0.34	0.69	3.4	16.2	0.43	216	0.030	0.051	0.34	13.8	11
0.27	0.86	3.2	22.9	0.39	338	0.047	0.104	0.57	13.2	12
0.29	0.92	1.1	22.9	0.26	626	0.053	0.062	0.58	12.8	13
1.09	0.91	15.6	36.2	0.20	31	0.087	0.047	1.16	15.4	14
3.67	1.42	80.9	17.4	0.49	trace	0.028	0.049	0.68	48	15
3.97	1.35	2.4	30.0	0.16	57	0.108	0.119	1.92	95	16
1.13	0.65	16.6	10.3	1.93	35	0.054	0.093	0.35	81.6	17
—	0.61	8.1	21.7	0.23	0	0.102	0.102	0.93	11.1	18
—	0.41	6.5	40.0	0.66	0	0.010	trace	0.30	1.1	19
—	0.33	3.1	35.4	0.66	0	trace	trace	0.26	trace	20

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
21	Fig 4 medium, 2¼″×2″ AP 3 large, 2½″×2¼″ AP	196	85.73	1.35	0.41	25.40
22	Grape, Isabella ½ cup, skin and seeds removed 1 cup, whole AP	156	82.25	0.70	0.30	26.36
23	Grapefruit 2½ medium, 2¾″×3½″ AP, peeled and membranes removed 1½ cups, sections	322	91.56	1.77	0.97	23.57
24	Green Sapote ⅓ medium, 4″×3¾″ AP, peeled and seeds removed	93	69.76	1.61	0.44	25.07
25	Guava, Cattley, Red[3] 30 medium, ¾″×⅞″ AP	152	81.64	0.70	0.58	25.70
26	Guava, Common, seeds removed[4] 1 cup, pulp and shell 2 medium, 2½″×2¼″ AP	182	84.35	0.51	(0.2)	26.92
27	Guava, Common, whole 1⅓ medium, 2½″×2¼″ AP	154	81.75	1.16	0.37	25.81
28	Java Plum 1⅓ cups, pitted	185	84.76	1.11	0.13	26.34
29	Ketambilla[5] 1 cup, pulp	213	86.39	3.20	0.28	24.32
30	Lime, juice 1⅔ cups	417	90.86	2.21	0.04	34.74
31	Loquat 9 medium, 2¼″×1¾″ AP, peeled and pitted	213	87.26	1.11	1.36	23.64

* See footnotes, page 62.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
1.74	0.80	55.5	41.6	0.31	127	0.071	0.076	0.67	4	21
0.31	0.33	11.7	24.8	0.34	162	0.117	0.076	0.30	3	22
1.00	0.87	70.2	53.5	0.29	0	0.167	0.081	0.80	173.6	23
0.10	1.00	32.4	18.9	0.39	679	trace	0.047	1.46	27.2	24
9.21	0.93	52.3	29.9	0.41	220	0.052	0.044	0.97	50	25
4.33	0.87	26.6	28.2	0.53	198	0.102	0.109	2.33	182	26
10.53	0.77	14.6	33.3	2.29	—	0.057	0.082	0.94	108-539	27
3.18	0.61	3.7	24.8	0.50	0	trace	—	0.44	50	28
0.28	1.19	17.5	25.6	0.96	505	0.026	0.111	0.53	141.2	29
0.21	1.13	39.2	35.4	0.46	—	0.083	0.142	0.96	104.7	30
1.77	1.02	19.8	23.2	0.30	2390	0.040	0.051	0.38	trace	31

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
32	Lychee, Brewster 11 medium, 1½″×1¼″ AP, peeled and pitted ¾ cup, peeled and pitted	147	80.96	1.10	0.32	26.02
33	Lychee, Kwai Mi 11 medium, 1⅜″×1⅛″ AP, peeled and pitted ⅔ cup, peeled and pitted	125	77.63	1.18	0.36	25.96
34	Macadamia Nut, cooked 7 small, ⅝″×⅝″ 4 medium, ⅝″×⅞″ 2 large, ¾″×1″	14	1.19	1.29	10.95	1.40
35	Mango, Haden 1 small, 3⅜″×3″ AP, peeled and pitted ¾ medium, 3⅝″×3¼″ AP, peeled and pitted ⅔ large, 4″×3½″ AP, peeled and pitted 1 cup, ½″ cubes	179	84.12	0.70	0.04	26.94
36	Mango, Pirie 1¼ small, 2⅝″×2¾″ AP, peeled and pitted ¾ medium, 3⅛″×3⅛″ AP, peeled and pitted ½ large, 3⅝″×3⅜″ AP, peeled and pitted ¾ cup, ½″ cubes	139	79.97	0.76	0.28	26.28
37	Mountain Apple 6 medium, 2″×1⅞″ AP, pitted 2⅓ cups, ½″ cubes	333	91.54	1.10	0.20	26.01
38	Mulberry 1½ cups	217	86.91	3.12	0.85	22.94
39	Ohelo Berry 2 cups	278	90.07	1.06	0.61	25.21

* See footnotes, page 62.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
0.79	0.54	15.3	32.8	0.24	0	0.022	0.088	1.01	118.8	32
0.20	0.46	4.9	43.2	0.46	0	0.044	0.105	2.39	50.2	33
0.26	0.20	7.5	33.7	0.28	0	0.030	0.017	0.22	—	34
0.97	0.75	14.5	18.6	0.29	6825	0.073	0.102	0.54	27	35
0.97	0.51	8.3	20.4	0.22	6582	0.113	0.083	0.64	21	36
2.66	0.87	23.3	43.3	1.27	0	0.097	0.120	0.80	77.9	37
2.08	1.50	85.5	82.5	4.01	33	0.063	0.219	1.35	79.0	38
3.67	0.72	20.02	28.1	0.25	1384	0.047	0.100	0.75	17	39

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
40	Orange	270	89.38	1.48	0.22	26.08
	3 small, 2⅝″×2¾″ AP, peeled and membranes removed					
	2 medium, 3″×3″ AP, peeled and membranes removed					
	1¼ large, 3½″×3⅜″ AP, peeled and membranes removed					
	1½ cups, sections					
41	Papaya, Solo, Hermaphrodite	217	86.80	0.85	0.13	26.43
	1 small, 4⅜″×3½″ AP, skin and seeds removed					
	¾ medium, 5″×4″ AP, skin and seeds removed					
	½ large, 5⅝″×4⅜″ AP, skin and seeds removed					
	1½ cups, ½″ cubes					
	1 cup, pulp					
42	Papaya, Solo, Pistillate	208	86.25	0.83	0.17	26.42
	½ medium, 4½″×4¼″ AP, skin and seeds removed					
43	Passion Fruit, Purple, juice	196	85.62	0.76	0.10	26.66
44	Passion Fruit, Yellow, juice	189	84.94	1.27	0.34	25.93
	¾ cup					
45	Persimmon, Hachiya	132	78.67	0.70	0.20	26.81
	1 medium					
46	Pineapple, Smooth Cayenne	192	85.54	0.86	0.40	25.94
	⅙ medium, 7″×5¼″ AP, peeled and cored					
	1¼ cups, ½″ cubes					
47	Plum, Methley	250	88.70	1.38	0.15	26.05
	5 medium, 1¾″×1¾″ AP, pitted					
	1½ cups, slices					

* See footnotes, page 62.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
0.49	0.89	62.4	55.4	0.54	1744	0.281	0.232	0.92	136.4	40
1.26	1.24	64.9	25.2	0.41	2372	0.059	0.093	0.72	182	41
1.25	1.19	85.1	32.2	0.44	4231	0.042	0.083	0.81	154.1	42
0.08	0.67	7.1	24.5	0.47	1405	trace	0.257	2.86	58.4	43
0.32	0.93	7.2	46.5	0.68	4555	trace	0.191	4.23	38	44
0.45	0.45	7.8	25.1	0.22	1300	trace	0.079	0.24	9.6	45
0.96	0.56	35.3	22.1	0.50	trace	0.163	0.069	0.46	19.4	46
2.22	0.68	12.8	31.5	0.35	212	0.030	0.082	0.92	8.0	47

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
48	Poha 1 cup	156	81.57	3.01	0.23	24.16
49	Pummelo or Shaddock ½ medium, 5½″×5½″ AP, peeled and membranes removed 1½ cups, sections	294	89.94	2.23	0.12	25.81
50	Roselle 5 cups, whole AP	482	90.96	2.82	1.88	20.37
51	Soursop[6] ¼ medium, 7″×5¼″ AP, peeled and strained ⅔ cup, pulp	141	82.18	0.97	0.55	25.70
52	Strawberry 2 cups	303	90.51	2.30	0.55	24.60
53	Surinam Cherry 43 medium, ⅞″×1⅛″ AP, pitted 1½ cups, pitted	256	89.03	1.18	0.13	26.16
54	Sweetsop ¾ medium, 2⅞″×3¼″ AP, peeled and seeds removed ½ cup, pulp	116	75.97	2.19	0.66	24.15
55	Tamarind 22 medium, 3″×1″ AP, peeled and seeds removed ⅓ cup, pulp	43	33.89	1.41	0.22	25.70
56	Tangerine 3¼ medium, 1¾″×2⅜″ AP, peeled and membranes removed 1½ cups, sections	294	90.13	2.09	0.15	25.81

* See footnotes, page 62.

Fiber	Ash	Calcium	Phosphorus	Iron	Vitamin A Value	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Item No.
grams	*grams*	*milligrams*	*milligrams*	*milligrams*	*International Units*	*milligrams*	*milligrams*	*milligrams*	*milligrams*	
4.95	1.36	11.2	73.9	1.45	2493	0.259	0.080	2.78	66	48
0.53	1.41	21.8	61.2	0.44	0	0.100	0.079	0.65	117.3	49
3.35	1.50	—	—	—	506	0.032	0.082	0.91	35.3	50
1.34	0.82	12.4	40.9	1.16	0	0.094	0.169	2.14	23.1	51
2.97	1.30	63.3	89.1	7.70	33	0.061	0.121	0.82	188.5	52
0.84	0.61	16.9	22.3	0.36	2867	0.061	0.138	0.59	48.1	53
1.64	0.87	19.7	62.2	0.35	0	0.121	0.066	1.03	41.6	54
0.77	1.11	48.8	41.0	0.26	0	0.066	0.093	0.55	trace	55
0.06	0.97	40.0	38.2	0.62	2440	0.309	0.065	0.47	90.6	56

(*Continued*)

TABLE 3. Composition of Hawaii fruits, in 100-calorie portions (*Continued*)*

ITEM NO.	Fruit and Approximate Measure[1]	Weight	Moisture	Protein	Fat	Total Carbohydrate
		grams	*per-cent*	*grams*	*grams*	*grams*
57	Watermelon, Charleston Gray ¾ wedge, 1/16 of 18½″×8¼″ melon AP, rind removed 2½ cups, ½″ cubes	385	92.64	1.96	0.19	25.18
58	Watermelon, Chilean Black Seeded 1 wedge, 1/16 of 9¼″×9½″ melon AP, rind removed 2 cups, ½″ cubes	294	90.20	2.65	0.32	24.75
59	Wi-apple 2 medium, 2¾″×2½″ AP, peeled, pitted, and fibers removed	200	85.94	1.06	0.56	25.66

*Note: "Trace" indicates that values were less than (<) 10 International Units for vitamin A value; < 0.010 milligram for thiamine and riboflavin; < 0.10 milligram for niacin; < 1 milligram for ascorbic acid.

"0" in the vitamin A value column indicates that in the absence of any yellow pigment it was assumed that no carotene or other usable carotenoid pigments were present.

"—" indicates that no determinations were made.

Figure in parentheses (p. 54, fat for guava) was estimated in order to supply a carbohydrate figure.

[1] The size of the fruits, shown as length times diameter in inches, includes the skin, i.e., as purchased, abbreviated AP. The weight and nutritive values are for the edible portion of the fruit as described, i.e., peeled and pitted or ½″ cubes, etc., with a few exceptions. See page 27. The measure for each fruit has been rounded so that fractions of fruits or cups are in fourths or thirds. If more accurate figures are required, use table 1 or 2.

[2] Minerals determined on juice; other nutrients on pulp.

[3] Vitamin values determined on fruit with seeds removed; other values on whole fruit.

[4] Vitamin values are averages for mixed seedling types; vitamin A value varies with color; typical ascorbic acid value given.

[5] Vitamin values determined on whole fruit; other values on pulp.

[6] Vitamin values determined on pulp; other values on juice.

Fiber	Ash	Calcium	Phos-phorus	Iron	Vitamin A Value	Thia-mine	Ribo-flavin	Niacin	Ascorbic Acid	ITEM NO.
grams	*grams*	*milli-grams*	*milli-grams*	*milli-grams*	*Inter-national Units*	*milli-grams*	*milli-grams*	*milli-grams*	*milli-grams*	
0.19	1.00	5.0	27.0	0.77	689	0.154	0.069	—	28.1	57
0.29	1.09	18.2	50.0	0.50	1364	0.112	0.118	0.59	18	58
1.66	0.84	20.2	43.2	0.62	720	0.104	0.030	2.66	101.2	59

TABLE 4. Portions considered refuse and percentage of refuse

FRUIT	PORTIONS CONSIDERED REFUSE	PERCENTAGE OF REFUSE
Acerola	seed and stem end	20
Avocado		
Beardslee	skin and seed	35
Hulumanu	skin and seed	24
Kahaluu	skin and seed	25
Nabal	skin and seed	30
Banana		
Dessert		
Bluefields (Gros Michel)	skin	32
Brazilian ("Apple")	skin	34
Chinese (Cavendish)	skin	34
Lacatan	skin	30
Williams Hybrid	skin	35
Plantain (Cooking)		
Largo	skin	39
Maiamaoli	skin	26
Popoulu	skin	15
Breadfruit, ripe	skin, stem, and core	23
Cactus Fruit	skin, stem and bud ends	5
Carambola, pulp	seeds	5
Carissa	seeds	7
Cherimoya	skin and seeds	35
Coconut, cream	shell, water, and residue	75
Fig	stem end	2
Grape, Isabella	skin, seeds, and stem	32
Grapefruit	skin, seeds, and membranes	40
Green Sapote	skin and seeds	29
Guava		
Cattley		
Red, seeds removed	seeds, stem and blossom ends	17
Red, whole	stem and blossom ends	3
Yellow, seeds removed	seeds, stem and blossom ends	13
Common		
Seeds removed	seeds, stem and blossom ends	20
Whole	stem and blossom ends	3
Java Plum	seed	19
Ketambilla		
Pulp	skin, seeds, and bud end	38
Whole	bud end	1
Lime, juice	skin, seeds, and pulp	55

(*Continued*)

TABLE 4. Portions considered refuse and percentage of refuse (*Continued*)

FRUIT	PORTIONS CONSIDERED REFUSE	PERCENTAGE OF REFUSE
Loquat	skin, seeds, and stem end	40
Lychee		
Brewster	skin and seed	44
Kwai Mi	skin and seed	38
Macadamia Nut	none	0
Mango		
Haden	skin and seed	33
Pirie	skin and seed	34
Mountain Apple	seed and stem end	13
Mulberry	none	0
Ohelo Berry	none	0
Orange	skin, seeds, and membranes	49
Papaya, Solo		
Hermaphrodite	skin and seeds	44
Pistillate	skin and seeds	37
Passion Fruit		
Purple, juice	skin, seeds, and pulp	66
Yellow, juice	skin, seeds, and pulp	60
Persimmon, Hachiya	skin	18
Pineapple, Smooth Cayenne	skin, crown, and core	44
Plum, Methley	seed	7
Poha	husks	6
Pummelo or Shaddock	skin, seeds, and membranes	44
Roselle	seed pods and stem	39
Soursop		
Juice	skin, seeds, and fibers	50
Pulp	skin and seeds	34
Strawberry	stem and cap	3
Surinam Cherry	seed, stem and blossom ends	22
Sweetsop	skin and seeds	45
Tamarind	seeds and pod	69
Tangerine	skin, seeds, and membranes	32
Watermelon		
Charleston Gray	skin and seeds	37
Chilean Black Seeded	skin and seeds	37
Wi-apple	skin, seed, and fibers	34

TABLE 5. Variation in the ascorbic acid content of mango varieties (*18*)

MANGO VARIETY	ASCORBIC ACID
	milligrams per 100 grams
Accession No. 1975	50
Bishop (2 seasons)	19–33
Bombay yellow	5
Borsha	15
Boswell	30
Brooks Late (2 seasons)	28–31
Cambodiana	35
Cigar (2 seasons)	119
Common (Manini) (6 samples, 3 seasons)	70–142
Fairchild (6 samples, 3 seasons)	8–26
Goa Alphonse	43
Haden (8 samples, 3 seasons)	11–17
Hansen	5
Holt (4 samples, 3 seasons)	18–58
Joe Welch	22
Julie (2 seasons)	50–53
Kalihi	54
Kruse	20
Lemon Chutney	31
Moreland	35
Number 9	37
Ono	33
Paris	20
Pirie (6 samples, 3 seasons)	12–16
Pirie, Jordan	26
Pirie, Koboni	13
Pirie, seedling	28
Robinson	21
Sandersha	26
Seedlings	
1	34
2	37
3	92
4	97
Smith-Wootten	80
Strawberry	24
Whitney	13
Wilcox	11
Wootten (2 seasons)	51–90

TABLE 6. Ascorbic acid variations in mangos of the Haden and Joe Welch varieties (*18*)

JOE WELCH			HADEN		
Sample	Weight, AP*	Ascorbic Acid	Sample	Weight, AP*	Ascorbic Acid
	grams	*milligrams per 100 grams*		*grams*	*milligrams per 100 grams*
1	328	28.9	1	326	8.7
2	404	26.6	2	333	10.6
3	437	21.4	3	350	10.0
4	377	27.4	4	377	7.3
5	430	23.5	5	372	8.7
6	357	21.6	6	390	9.6
7	390	22.6	7	322	9.4
8	508	23.7	8	263	13.5
9	463	26.2	9	293	9.1
10	473	21.9	10	248	13.3
Mean		24.4	Mean		10.0
S.D.†		2.69	S.D.†		1.99
S.E.‡		0.85	S.E.‡		0.63

* AP = "As Purchased." † S.D. = Standard Deviation. ‡ S.E. = Standard Error.

TABLE 7. Changes in ascorbic acid content of fruit during ripening (*19*)

FRUIT	GREEN	HALF-RIPE	RIPE
		ascorbic acid, milligrams per 100 grams	
Mango			
Cigar	—	154	119
Common (Manini)	188	145	114
Fairchild	—	31	19
Haden	42	—	14
Indian race	—	61	56
Itamaracca	—	53	40
Number 9	43	37	30
Philippine type	—	25	15
Pirie	60	50	14
Pirie, seedling	—	60	28
Sandersha	—	33	26
Smith-Wootten	—	105	79
Strawberry	42	—	24
Wootten	103	—	63
Papaya			
Series 1 (large-fruit type)	40	53	68
Series 2 (Solo)	72	95	102
Poha	31	36	42

APPENDIX:

DESCRIPTION AND TREATMENT OF SAMPLES

The history (origin, cultural practices, handling after harvest, etc.) and preparation are given for most of the samples. Locations of sources are for the island of Oahu (City & County of Honolulu) unless stated otherwise. The weights of samples in pounds are as purchased, and dimensions are given as length by width or diameter. In general, preparation involved washing the fruit with tap water and drying with cheesecloth or with an electric fan. All analyses and assays were done on the edible portions only. For percentage of refuse and portions considered refuse see table 4. An electric blender was used for comminuting and mixing the edible portions unless otherwise stated.

Complete descriptions of samples were not available in the data books for some of the earlier publications. If a description is not given, it should be understood that (1) the sample was of good market quality, (2) the variety was unknown if not listed, and (3) portions taken for assays constituted representative sampling of the whole.

To simplify the main tables, only one figure is given for each nutrient, although analyses may have been done on several samples of a fruit. In these cases, values were recalculated to a single moisture basis and mean averages are reported. This accounts for slight differences between these and some published figures.

Acerola

Sample 1. Two pounds of fruits from Station Farm, Manoa Valley. Size range, ⅝ to 1 inch in diameter. Ripened at room temperature, refrigerated overnight. All edible portion blended. Ascorbic acid, thiamine, riboflavin, carotene, and phosphorus assayed.

Sample 2. About 2 pounds of fruits, harvested 2 days later, from same source. Same treatment. Proximate composition, calcium, iron, and niacin determined.

Avocado, Beardslee

Sample. Three fruits, weighing 5 pounds, from Manoa Valley. Size range, 5×4½ to 5¼×4¼ inches. Ripened at room temperature. Flesh yellow, smooth, and buttery. All nutrients assayed.

Avocado, Hulumanu

Sample 1. Three fruits, weighing 3¾ pounds, from Station Farm, Kona, Hawaii. Size range, 6½ to 8 inches in length. Ripened at room temperature, refrigerated 2 days. Poor quality, flesh slightly bitter and stringy. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Nine fruits, weighing 12½ pounds, from Hawaiian Avocado Company, Pupukea. One-quarter of each fruit used and mashed with silver fork. Proximate composition and minerals determined (*17*).

Avocado, Kahaluu

Sample. Six fruits, weighing 5¾ pounds, from Station Farm, Kona, Hawaii. Size range, 3⅞×3¼ to 4⅜×3⅝ inches. Ripened at room temperature, refrigerated as they ripened. Excellent quality. Opposite quarters cut into 1-inch cubes. Carotene, ascorbic acid, proximate composition, and minerals determined.

Avocado, Nabal

Sample 1. Six fruits, weighing 8 pounds, from Station Farm, Kona, Hawaii. Size range, 4×3⅞ to 4½×4¼ inches. Ripened at room temperature. Excellent quality. Opposite quarters cut into 1-inch cubes. All vitamins except niacin assayed.

Sample 2. Four fruits, weighing 4½ pounds, from Laie. All edible portion mashed with fork. Proximate composition and minerals determined (*17*).

Banana, Bluefields (Gros Michel)

Sample 1. Three fruits, weighing 1¼ pounds, grown at Waimanalo, purchased at market. Average length, 7 inches. Skin yellow with some brown flecks. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Four fruits of similar description used for carotene (*18*).

Sample 3. Eight fruits from one hand, from Kaneohe. Ascorbic acid assayed (*19*).

Sample 4. Twelve fruits, weighing 3½ pounds, grown at windward Oahu, purchased at market. All edible portion mashed with silver fork. Proximate composition and minerals determined (*17*).

Banana, Brazilian ("Apple")

This variety is often erroneously called "Apple" banana in Hawaii.

Sample 1. Ten fruits from one hand, weighing 3 pounds, grown in Honolulu. Size range, 6×1¾ to 7×2 inches. Good quality. All edible portion blended. All vitamins determined (*18*).

Sample 2. Five fruits, weighing 1½ pounds, grown at windward Oahu, purchased at market. Ripened at room temperature. Edible portion mashed with silver fork. Proximate composition and minerals determined (*17*).

Banana, Chinese (Cavendish)

Sample 1. Five fruits, weighing 1¾ pounds, from Station Farm, Manoa Valley. Average size, 6½×1½ inches. Yellow with brown specks. All edible portion blended. Thiamine, riboflavin, and niacin determined (*18*).

Sample 2. Seven fruits from same source, ripened at room temperature. All edible portion blended and used for carotene determination (*18*).

Sample 3. Eight fruits from one hand, from Poamoho. Ascorbic acid assayed (*19*).

Sample 4. Twenty-five fruits from three hands, weighing 7 pounds, grown in Manoa Valley, purchased at market. Size range, 5×1⅜ to 6½×1½ inches. Ripened at room temperature. Good quality. Half of each hand blended and minerals determined.

Sample 5. Proximate composition determined (*27*).

Banana, Lacatan

Sample 1. Sixteen fruits from one hand, weighing 6 pounds, from Station Farm, Poamoho. Size range, 6×1⅜ to 6½×1¾ inches. Ripened at room temperature. Excellent quality. Eight fruits blended. Carotene and ascorbic acid determined.

Sample 2. Seventeen fruits from one bunch, weighing 4 pounds, from same source as sample 1. Size range, 4½×1⅜ to 5⅛×1⅜ inches. Ripening process hastened by use of a ripening agent. Good quality. All edible portion blended. Proximate composition and minerals determined.

Banana, Williams Hybrid

Sample. Thirty fruits from two hands, weighing 14 pounds, from Station Farm, Poamoho. Size range, 6×1½ to 7×1¾ inches. Ripened at room temperature. Excellent quality. Longitudinal half of each banana blended. All nutrients determined.

Banana (Plantain), Largo

Sample 1. Nine fruits, weighing 5 pounds, from Station Farm, Kona, Hawaii. Size range, 6¾×2¼ to 7¼×2¾ inches. Ripened at room temperature. All edible portion blended. All nutrients, except crude fiber and fat, determined.

Sample 2. Twenty-four fruits, weighing 7⅓ pounds, from one bunch, weighing 9½ to 10 pounds, grown at Station Farm, Honolulu. Flesh chopped. Crude fiber and fat determined (*17*).

Banana (Plantain), Maiamaoli

Sample. Seven fruits, weighing 5 pounds, from Station Farm, Kona, Hawaii. Average size, 7½×2⅞ inches. Ripened at room temperature, refrigerated 4 days. All edible portion blended. All nutrients determined.

Banana (Plantain), Popoulu

Sample 1. Five fruits from three hands of one bunch, weighing 1½ pounds, from Station Farm, Poamoho. Size range, 4¼×1¾ to 4½×2⅝ inches. Flesh pinkish-yellow. All edible portion blended. All vitamins determined (*18*).

Sample 2. Four fruits, from one bunch, weighing 2½ pounds, from Station Farm, Kona, Hawaii. Size range, 5½×2½ to 5¾×2½ inches. Ripened at room temperature. All edible portion blended. Proximate composition and minerals determined.

Breadfruit, Ripe

Sample 1. One fruit from tree on University campus. Ripened at room temperature, refrigerated 2 days. Thiamine and riboflavin assayed (*18*).

Sample 2. One fruit from tree on University campus. Ripened at room temperature. Chopped and used for carotene assay (*18*).

Sample 3. Three fruits, weighing 5⅓ pounds, from University campus. Size range, 4×4¾ to 5½×4½ inches. Ripened at room temperature. Half of each fruit used for ascorbic acid and niacin assay (*18*).

Sample 4. Four, two, and three fruits, weighing 7½, 6½, and 7 pounds, respectively, from three different trees on University campus. Ripened at room temperature. Portions from each used for ascorbic acid assay. Mean ascorbic acid value adjusted for moisture content and averaged with value from sample 3.

Sample 5. Seven fruits from Nuuanu Valley. Chopped. Proximate composition and minerals determined (*17*).

Cactus Fruit

Sample 1. Twenty-eight fruits, weighing 5½ pounds, from Waianae foothills. Average size, 3¼×2 inches. Refrigerated overnight. Thorns scraped off and edible portion blended. Ascorbic acid, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Eight fruits from same source, prepared as in sample 1, used for carotene assay (*18*).

Sample 3. Eleven fruits, weighing 4 pounds, from one plant at Alewa Heights. Size range, 2¾×2¼ to 3½×2½ inches. All edible portion blended and frozen. Proximate composition and minerals determined.

Carambola

Sample 1. Eighteen fruits, weighing 3¼ pounds, from one tree, Honolulu. Size range, 2⅜×1¾ to 3½×2½ inches. Cut and blended. Carotene, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Three lots of three or four fruits each, from different sources, different years. One lot sweet, one semisweet, and one sour. Ascorbic acid assayed. Mean value reported (*19*).

Sample 3. Proximate composition determined (*27*).

Sample 4. Twenty-eight fruits, weighing 3 pounds, from Station Farm, Honolulu. Fruit cut into pieces and juice expressed through six thicknesses of cheesecloth. Minerals determined (*17*).

Carissa

Sample 1. Sixty-four fruits, weighing 2 pounds, from Wilhelmina Rise. Size range, 1¼×⅝ to 2×1½ inches. All cut and mixed. All vitamins assayed (*18*).

Sample 2. Five to 6 pounds from Kamehameha Heights. Size range, 1×¾ to 1⅜×1½ inches. Refrigerated 2 days. About 2 pounds selected at random for sample. Electric grinder used for comminuting. Proximate composition and minerals determined.

Cherimoya

Sample 1. Five fruits, weighing 6 pounds, from Station Farm, Kona, Hawaii. Carters, Chaffey, and Bay varieties with two, two, and one fruit, respectively. Size of Bay, the largest, 3×3⅞ inches. All varieties combined. All vitamins, minerals, and protein determined.

Sample 2. Fat determined (*27*).

Coconut Cream *(20)*

Nuts gathered over a 4-week period from two adjoining private gardens in Manoa Valley husked and examined. Twenty-one heavy nuts selected from a lot of 40 for grating. Water drained through pierced eyes, then nuts cracked into halves. Coconut meat grated, without removal from shell, on a Polynesian grater, within 3 hours. Entire amount of approximately 7500 grams mixed and divided into two equal lots, from which two coconut cream samples prepared.

Sample 1. To the first lot 4¾ cups of drained water from 21 coconuts added and thoroughly mixed by kneading with hands. About 2-cup quantities placed in one thickness of cheesecloth in a 2-quart, screw-type household press, and as much cream expressed as possible. Cream expressed from entire first lot yielded 2000 milliliters. All nutrients except crude fiber determined.

Sample 2. To the second lot no water added. Cream expressed in same manner as in sample 1. Cream expressed from entire second lot yielded 1200 milliliters. All nutrients except crude fiber determined.

Coconut Water

Sample 1. Sixteen immature nuts from trees on University campus. Yellow-green husks removed and nuts stored 3 days at 3°C. Water obtained by piercing eyes, filtered before assay. B vitamins determined (*18*).

Sample 2. Immature nuts from trees on Waialae Golf Course. Top of husk chopped off and small piece of soft shell cut away. Coconut water siphoned off through glass tube into beaker. Minerals determined (*17*).

Fig

Sample 1. Two pounds of fruits from one tree in Manoa Valley. Average size, 2¼×2⅛ inches. All blended. Carotene, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Two lots of four figs each, different years. Ascorbic acid assayed. Mean value reported (*19*).

Sample 3. Eighteen fruits from Punaluu. Chopped for proximate composition, but left whole for ash and mineral determinations (*17*).

Grape, Isabella

Sample 1. Sixteen bunches, 30 to 40 grapes per bunch, weighing 3 pounds, Oahu-grown. Average size, ¾×⅝ inch. Skin and seeds removed. Carotene, thiamine, riboflavin, and niacin determined (*18*).

Sample 2. Sample taken from several clusters of one lot. Ascorbic acid assayed on pulp only (*19*).

Sample 3. One bunch, weighing 3 pounds, from Manoa Valley. Fruit squeezed from skin, and seeds removed with ivory-tipped forceps. Pulp shredded with silver fork. Aliquot for iron sample ashed without drying. Proximate composition and other minerals determined on material which had been dried at low temperature for several days (*17*).

Grapefruit

Sample. Twelve fruits, weighing 6 pounds, from Kona, Hawaii, purchased at market. Size range, 2¾×3¼ to 2¾×3¾ inches. Yellow-green skin with dark spots, pale yellow pulp. Membranes removed from all sections and pulp thoroughly mixed. All nutrients determined.

Green Sapote

Sample. Thirty-five fruits, weighing 13 pounds, from Station Farm, Kona, Hawaii. Size range, 3¾×2¾ to 4×3¾ inches. Ripened at room temperature and refrigerated as they ripened. Sixteen fruits of best quality and same stage of ripeness cut into 1-inch cubes. Cut surfaces oxidized. All nutrients determined.

Guava, Cattley, Red

Sample 1. One pound of fruits from Tantalus. Size range, ⅝ to 1 inch in diameter. Pulp scooped out from fruit, and seeds removed by pressing through sieve. Pulp and shells combined and blended for thiamine, riboflavin, and niacin assays (*18*).

Sample 2. One and one-half pounds of fruits from Koolau foothills near Laie. Size range, ⅝ to 1¼ inches in diameter. Whole fruit used but seeds not ground. Carotene assayed (*18*).

Sample 3. Two lots of 10 and 11 fruits each, from two sources. Ascorbic acid assayed. Mean value reported (*19*).

Sample 4. Five pounds of fruits from Tantalus. Size range, 1 to 1½ inches in diameter. Fruit chopped and dried. Proximate composition and minerals determined. Iron sample taken from slices from several fresh guavas (*17*).

Guava, Cattley, Yellow

Sample 1. Three and one-third pounds of fruits from Manoa Valley. Size range, ¾ to 1 inch in diameter. Refrigerated 2 days. Pulp scooped out from

fruit and seeds removed by pressing through sieve. Pulp and shells combined and blended. Thiamine, riboflavin, niacin, and carotene assayed (*18*).

Sample 2. One pound of fruits from same source, prepared as in sample 1. Size range, 1 to 1½ inches in diameter. Ascorbic acid assayed (*18*).

Guava, Common, Seeds Removed

Sample 1. Twelve fruits, weighing 2 pounds, from Station Farm, Poamoho. Size range, 1¾ to 2½ inches in length. Sour, red pulp; small fruit. Pulp pressed through sieve; seed-free pulp and shells blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Nine fruits of similar description and from same source, prepared as in sample 1, used for carotene assay (*18*).

Sample 3. Six fruits, weighing 2½ pounds, from Station Farm, Poamoho. Size range, 2¼ to 3¼ inches in length. Fairly sweet, white pulp, yellow shell. Prepared as in sample 1. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 4. Ten fruits of same description and from same source as sample 3, prepared as in sample 1, used for carotene assay (*18*).

Sample 5. Six fruits, weighing 2½ pounds, from Station Farm, Poamoho. Size range, 2¾ to 3¾ inches in length. Fairly sweet, pink pulp, green shell. Prepared as in sample 1. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 6. Nine fruits of same description and from same source as sample 5, prepared as in sample 1, used for carotene assay (*18*).

Vitamin values reported are adjusted mean values of samples 1 through 6. A typical value for ascorbic acid is given.

Sample 7. Three fruits from Manoa Valley. Lengthwise section of a fruit taken for each determination; seeds carefully removed and cleaned of all adhering flesh before being discarded. Proximate composition and minerals determined (*17*).

Guava, Common, Whole

Sample 1. Seventeen fruits, weighing 3¾ pounds, from Station Farm, Poamoho. Size range, 2×1⅝ to 4½×2⅝ inches. Pink pulp, yellow shell. Fruits cut into sections; seeds part of sample but did not break during analyses. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. One hundred samples from different areas on Oahu. Ascorbic acid assayed. Range of values reported (*19*).

Sample 3. Twelve fruits, weighing 2 pounds, from Waimanalo. Fruit chopped, except aliquot used for iron determination, which consisted of representative slices cut from several guavas. Proximate composition and minerals determined (*17*).

Java Plum

Sample 1. Eight and three-fourths pounds of fruits from Manoa Valley. Average size, 1⅛×⅞ inches; purple skin, white flesh, good quality. All edible portion blended. Thiamine and niacin determined (*18*).

Sample 2. Four pounds of fruits from same source as sample 1 used for carotene assay. Prepared as in sample 1 (*18*).

Sample 3. One sample of 10 small and 10 large, white-fleshed fruits from Molokai. Ascorbic acid assayed (*19*).

Sample 4. Fruits from Kailua. Proximate composition and minerals determined.

Ketambilla

Sample 1. Two and one-third pounds of fruits, grown on Oahu. Average size, ¾×⅞ inch. Some very ripe, some slightly green. All edible portion blended. All vitamins assayed (*18*).

Sample 2. One and one-fourth pounds of fruits from Waipahu. Size range, ½×⅜ to ⅝×¾ inch. Slightly green fruits. All frozen. All blended and filtered through coarse cloth, known locally as "poi cloth." Juice only used. Proximate composition and minerals determined.

Lime, Juice

Sample 1. Two and three-fourths pounds of fruits, Mexican variety, purchased at market. Size range, 1¼ to 1¾ inches in diameter. Juice filtered through one thickness of cheesecloth. Thiamine, riboflavin, and niacin determined (*18*).

Sample 2. Thirty-seven fruits, Kusaie variety, weighing 2 pounds, purchased at market. Size range, 1¼×1 to 1¾×1¾ inches. Prepared as in sample 1. Ascorbic acid determined (*18*).

Sample 3. Protein, fiber, and ash determined (*27*).

Sample 4. Twenty-two fruits, Kusaie variety, weighing 2 pounds, from Station Farm, Manoa. Collected from one tree over a period of 1 week. Size range, 1¼×1⅜ to 1⅞×1¾ inches. Prepared as in sample 1. Minerals and fat determined.

Loquat

Sample 1. Twenty-one fruits, weighing 1½ pounds, from Kula, Maui. Size range, 1¾×1⅜ to 2¼×1⅞ inches. Refrigerated over weekend. Good quality. Peeled and blended. Vitamins and minerals determined.

Sample 2. Seven pounds of fruits from same source as sample 1. Size range, 1¾×1½ to 2½×2 inches. Refrigerated overnight. All peeled, quartered, and mixed thoroughly. Vitamins and minerals determined.

Adjusted mean values of samples 1 and 2 reported.

Sample 3. Proximate composition determined (*27*).

Lychee, Brewster

Sample 1. Three and one-half pounds of fruits from Station Farm, Poamoho. Thiamine, niacin, and riboflavin assayed (*18*).

Sample 2. Nine and 13 fruits from same source as sample 1, a year apart, used for ascorbic acid (*18*).

Sample 3. Five pounds of fruits from Station Farm, Poamoho. Size range,

1⅜×1⅛ to 1⅝×1⅝ inches. Edible portion blended and frozen. Proximate composition and minerals determined.

Lychee, Kwai Mi

Sample 1. Three pounds of fruits from lower Nuuanu Valley. Size range, 1⅜×1⅛ to 1½×1¼ inches. Harvested night before analyses started. Half of each fruit used. Ascorbic acid, thiamine, riboflavin, and niacin assayed.

Sample 2. Three and one-half pounds of fruits from Station Farm, Honolulu. Edible portion dried for several days at low temperature. Sample for iron determination used without drying. Proximate composition and minerals determined (*17*).

Macadamia Nut

Sample 1. Roasted, salted nuts packed by the Hawaiian Macadamia Nut Factory. Salt removed from nuts. Cut and mixed. B vitamins determined (*18*).

Sample 2. Roasted, unsalted nuts from two 12-ounce jars from same source as sample 1. Cut into very thin slices with stainless steel knife on bakelite board, and mixed. Proximate composition and minerals determined (*15*).

Sample 3. Three 12-ounce jars of nuts of same description and source as sample 2, obtained 3 months later. Proximate composition and minerals determined (*15*).

Adjusted mean values of samples 2 and 3 reported.

Mango, Haden

Sample 1. Three fruits, weighing 2 pounds, from Station Farm, Poamoho. Size range, 3 to 4½ inches in length. Ripened at room temperature. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Three fruits, weighing 2 pounds, from Kauai. Size range, 3 to 4½ inches in length. Ripened at room temperature. All edible portion blended. Riboflavin and niacin assayed (*18*).

Adjusted mean values of samples 1 and 2 reported.

Sample 3. Three fruits from Station Farm, Poamoho. Carotene assayed (*18*).

Sample 4. Ten fruits, each assayed for ascorbic acid. Mean value reported (*18*).

Sample 5. Fifteen fruits, weighing 10 pounds, from 10 trees at Station Farm, Poamoho. Size range, 3¾×3¼ to 4½×3⅝ inches. Ripened at room temperature. All edible portion blended. Proximate composition and minerals determined.

Mango, Pirie

Sample 1. Seven fruits, weighing 3 pounds, from Station Farm, Poamoho. Size range, 3 to 3½ inches in length. Ripened at room temperature. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Three fruits from same source as sample 1. Carotene assayed (*18*).

Sample 3. Two to four fruits from three sources, 3 seasons. Ascorbic acid assayed. Mean value reported (*19*).

Sample 4. Ten fruits, weighing 4⅓ pounds, from Station Farm, Honolulu. Ripened at room temperature and refrigerated 2 days. Sliced and chopped. Proximate composition, calcium, and phosphorus determined (*17*).

Sample 5. Iron assayed on another sample, 1 week later (*17*).

Mountain Apple

Sample 1. Three pounds of fruits from Manoa Valley, purchased at market. Size range, 1½×1¼ to 2×1½ inches. Chopped coarsely. Thiamine and niacin assayed (*18*).

Sample 2. Twelve fruits, weighing 1 pound, from same source as sample 1. Riboflavin assayed (*18*).

Sample 3. Ten fruits from Nuuanu Valley. Ripened at room temperature for 2 days, refrigerated overnight. Ascorbic acid assayed (*18*).

Sample 4. Twenty-nine fruits, weighing 4 pounds. Slices dried in electric oven on enamel trays at temperature under 65°C. Proximate composition and minerals determined. For iron determination, fresh sample used (*17*).

Mulberry

Sample 1. One and one-half pounds of fruits from Makiki. All blended. All vitamins determined (*18*).

Sample 2. Two pounds of fruits from Ewa. Refrigerated over weekend. Excellent quality, all blended. Proximate composition and minerals determined.

Ohelo Berry

Sample 1. Two and one-third pounds of fruits from Hawaii National Park, Hawaii, via airfreight. Size range, ¼ to ½ inch in diameter. Good quality. Carotene, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Two lots from Volcano District, Hawaii, 2 seasons. Ascorbic acid assayed. Mean value reported(*19*).

Sample 3. Four pounds of fruits from Hawaii National Park, Hawaii, via airfreight. Size range, ¼×¼ to ½×½ inch. Frozen upon receipt. All blended. Proximate composition and minerals determined.

Orange

Sample 1. Seven fruits, weighing 3 pounds, purchased at market. Size, 3×3½ inches. Skin and membranes removed from sections, and pulp blended. Carotene, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Five fruits, weighing 1½ pounds, from Kona, Hawaii, purchased at market. Slightly sour. Average size, 2¼×2¾ inches. Prepared as in sample 1. Ascorbic acid assayed (*18*).

Sample 3. Twelve fruits from Kealakekua, Hawaii. Sections without surrounding membranes used. Not possible to chop or mash sections without losing comparatively large quantities of juice, so true composite sample not prepared. Where more than one section used, these taken from several different fruits. Proximate composition and minerals determined (*17*).

Papaya, Solo, Hermaphrodite

Sample 1. Four fruits, weighing 2½ pounds, from Station Farm, Poamoho. Size range, 4½ to 5½ inches in length. Edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Five fruits, weighing 5¼ pounds, purchased at market. Thiamine, riboflavin, niacin, and carotene assayed (*18*).

Adjusted mean values of samples 1 and 2 reported for B vitamins.

Sample 3. Forty-five samples from Station Farm, Poamoho, and 40 samples from Kailua, collected at weekly intervals over period of 1 year, except for month of August. Ascorbic acid assayed. Mean value reported (*19*).

Sample 4. Five fruits, weighing 5 pounds, from Station Farm, Waimanalo. Size range, 4¾×3 to 5¼×4 inches. Ripened at room temperature. Each fruit quartered, then one slice from each quarter pooled and blended. Proximate composition and minerals determined.

Papaya, Solo, Pistillate

Sample 1. Four fruits, weighing 3¼ pounds, from Station Farm, Poamoho. Size range, 3½ to 4 inches in length. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Five fruits, weighing 8½ pounds, from Station Farm, Waimanalo. Ripened at room temperature. Each fruit quartered, then one slice from each quarter pooled and blended. Proximate composition, minerals, ascorbic acid, and carotene assayed.

Passion Fruit, Purple, Juice

Sample 1. Five and one-half pounds of fruits from Kokee, Kauai. Size range, 1¾×1½ to 2×1⅞ inches. Ripened at room temperature. Pulp and seeds squeezed through two thicknesses of cheesecloth. All vitamins assayed (*18*).

Sample 2. Eighty-six fruits, weighing 7 pounds, from Station Farm, Kona, Hawaii. Fruit cut in half, pulp and seeds removed from shell with silver spoon. Pulp and seeds squeezed through four thicknesses of cheesecloth. Protein and minerals determined (*17*).

Sample 3. Fifteen fruits, from Kokee, Kauai. Size range, 1½×1½ to 1¾×1½ inches. Prepared as in sample 1. Fat and crude fiber determined.

Passion Fruit, Yellow, Juice

Sample 1. Sixty-three fruits, weighing 6 pounds, from Oahu. Harvested over a 3-week period and refrigerated until analyzed. Pulp and seeds squeezed through two thicknesses of cheesecloth. Thiamine, riboflavin, niacin, and carotene assayed (*18*).

Sample 2. Two lots, four fruits each, from two sources, 2 seasons. Ascorbic acid assayed. Mean value reported (*19*).

Sample 3. Eight 8-ounce jars of juice from Station Food Processing Laboratory. Juice prepared in pilot-plant juicer, pulp and juice separated from seeds and frozen in plastic bags for 4 months. One bag thawed to fill jars and refrozen before being transferred to Foods and Nutrition Department. Proximate composition and minerals determined.

Persimmon, Hachiya

Sample. Thirteen seedless fruits, weighing 5 pounds, grown on Maui, purchased at market. Size range, 2¼×2¼ to 3×2¾ inches. Ripened at room temperature. Peeled, separated into sections, cut crosswise, and mixed. All nutrients determined.

Pineapple, Smooth Cayenne

Sample 1. Three fruits from Pineapple Research Institute of Hawaii, Honolulu. Cross-section slices taken from fruits and blended. Riboflavin and niacin assayed (*18*).

Sample 2. Three fruits from Pineapple Research Institute of Hawaii, Honolulu. Opposite longitudinal quarters used. Thiamine, carotene, and ascorbic acid assayed (*18*).

Sample 3. Four fruits, weighing 28 pounds, grown at Wahiawa. Size range, 8½ to 9½ inches in length, 5 to 6 inches in diameter. Edible portion diced. Proximate composition and minerals determined (*17*).

Plum, Methley

Sample 1. Forty-five fruits, weighing 2 pounds, from Kokee, Kauai, purchased at market. Size range, 1⅛×1⅛ to 1½×1⅜ inches. Edible portion, including skin, cut from seeds. Thiamine, niacin, and carotene assayed (*18*).

Sample 2. Forty pounds of fruits from Kokee, Kauai. About 5 pounds randomly picked for analyses. Size range, 1¼×1⅛ to 1¾×1⅝ inches. Skin removed and analyzed separately from flesh; flesh blended. Proximate composition and minerals determined separately on skin and flesh but calculated for whole fruit. Ascorbic acid and riboflavin assayed on whole fruit.

Poha

Sample 1. One pound of fruits grown on Hawaii, purchased from wholesaler. All edible portion blended. Thiamine and riboflavin assayed (*18*).

Sample 2. Two pounds of fruits from same source as sample 1. Size range, berries, ⅝×⅝ to ¾×¾ inch. All edible portion blended. Niacin and carotene assayed (*18*).

Sample 3. Two lots of eight or nine representative berries each, from Volcano District, Hawaii. Ascorbic acid assayed 36 hours after harvest. Mean value reported (*19*).

Sample 4. Two 4-pound lots of fruits from Kona, Hawaii, 3 months apart. Proximate composition, calcium, and phosphorus determined on material which

had been dried for several days at low temperature and ground in a glass mortar. Fresh material without previous drying ashed for iron determinations (*17*).

Pummelo or Shaddock

Sample 1. Two fruits, weighing 7 pounds, grown in Manoa Valley. Size, 6½×5 and 6½×6 inches. Juicy and sour. Skin and membranes removed and pulp blended. Riboflavin and niacin assayed (*18*).

Sample 2. Three fruits, weighing 8½ pounds, from Station Farm, Poamoho. Thiamine assayed (*18*).

Sample 3. Three fruits, weighing 7½ pounds, from Station Farm, Poamoho. Size range, 5¼×5½ to 5½×5¾ inches. Ripened at room temperature. Skin and membranes removed. Proximate composition, minerals, and ascorbic acid determined.

Roselle

Sample 1. Six pounds of fruits from Station Farm, Manoa Valley. Size range, 1×¾ to 2×1¼ inches. Only calyxes used. Cut coarsely and mixed. Thiamine, riboflavin, niacin, and carotene assayed (*18*).

Sample 2. One pound of fruits from same source as sample 1. Calyxes cut coarsely. Ascorbic acid assayed (*18*).

Sample 3. Proximate composition determined (*27*).

Soursop

Sample 1. Two fruits, weighing 4 pounds, grown in Honolulu. Size range, 5½×4½ to 8½×3½ inches. One fruit riper than other. Fruit pulp first pressed through colander, then squeezed through cheesecloth. Ascorbic acid, thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. One fruit, weighing 4⅓ pounds, from Station Farm, Honolulu. Size, 11×5½ inches. Ripened at room temperature. Fruit peeled, seeds removed, and flesh sliced and chopped. Proximate composition and minerals determined (*17*).

Strawberry

Sample 1. Two pounds of fruits grown at Kaneohe, purchased from wholesaler. Size range, ½×¾ to 1¼×1 inch. Good quality. Cut coarsely. All vitamins assayed (*18*).

Sample 2. One pound of fruits from Kaneohe. Chopped. Proximate composition and minerals determined (*17*).

Surinam Cherry

Sample 1. Two ¾-pound samples of fruits harvested 4 days apart at Station Farm, Poamoho. Average size, ⅞×1 inch. Good quality. Riboflavin, niacin, and ascorbic acid assayed on one sample, thiamine and carotene on other (*18*).

Sample 2. One and one-half pounds of fruits from Station Farm, Honolulu. Proximate composition and minerals determined (*17*).

Sweetsop

Sample 1. Five fruits, weighing 2 pounds, from Alewa Heights. Size range, 2½×2¾ to 2¾×3¼ inches. Ripened at room temperature, refrigerated as they ripened. Three good, two fair quality. All edible portion blended. Ascorbic acid, thiamine, riboflavin, and niacin determined.

Sample 2. One fruit weighing 1 pound from same tree as sample 1. Size, 3¾×4¼ inches. Excellent quality. Edible portion blended. Minerals determined.

Sample 3. Proximate composition determined (*27*).

Sample 4. Proximate composition determined (*27*).

Adjusted mean values of samples 3 and 4 used.

Tamarind

Sample 1. Nine pounds of fruits from trees in Manoa Valley. Average size, 4×¾ inches. Fair quality. Edible portion scraped from seeds. Thiamine, riboflavin, niacin, and ascorbic acid assayed (*18*).

Sample 2. Four and one-half pounds of fruits from tree at Punahou School. Shell removed from fruit, sticky pulp scraped from seeds. Proximate composition and minerals determined (*17*).

Tangerine

Sample 1. Twelve fruits, weighing 3 pounds, grown in Puna, Hawaii, obtained through wholesaler. Size range, 1½×2⅜ to 1¾×2½ inches. Good quality. Refrigerated 1 week. Fruits peeled, membranes removed from each section, and pulp from entire sample mixed. Ascorbic acid, thiamine, riboflavin, and calcium assayed.

Sample 2. Twenty-four fruits, weighing 5½ pounds, Hawaii-grown, purchased at market. Size range, 1⅞×2½ to 1⅞×2¾ inches. Good quality. Refrigerated overnight. Prepared as in sample 1. Carotene, niacin, phosphorus, iron, and proximate composition determined.

Watermelon, Charleston Gray

Sample. Five melons, weighing 120 pounds, from Station Farm, Waimanalo. Size range, 14½×7½ to 20×9 inches. Excellent quality. Refrigerated 4 days. Edible portion from opposite one-eighth longitudinal sections blended. All nutrients except niacin determined.

Watermelon, Chilean Black Seeded

Sample 1. Four 1-pound wedges from two melons grown at Kahuku, purchased at market. Good quality. Riboflavin and niacin assayed (*18*).

Sample 2. Three melons from Waimanalo, medium-size, with green skin, black seeds. Wedges taken from each, totaling 4 pounds. Thiamine and carotene assayed (*18*).

Sample 3. Two melons, one each from Maui and Oahu. Ascorbic acid assayed on flesh from stem ends, centers, and bud ends. Mean of 14 assays reported (*19*).

Sample 4. Two melons, weighing 38 pounds, from wholesaler. Flesh diced. Proximate composition and minerals determined (*17*).

Wi-apple

Sample 1. Eight fruits, weighing 3 pounds, from tree in Honolulu. Size range, 2¼ to 3¼ inches in length. Ripened at room temperature. All edible portion blended. Thiamine, riboflavin, and niacin assayed (*18*).

Sample 2. Thirteen fruits from same source as sample 1. Carotene and ascorbic acid assayed (*18*).

Sample 3. Thirteen fruits, weighing 4½ pounds, from tree in Honolulu. Size range, 2⅜×2⅛ to 3×2⅞ inches. Foley food mill used to prepare pulp. Protein, ash, and minerals determined.

Sample 4. Proximate composition determined (*27*).

Adjusted mean protein and ash values reported.

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